ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE,

BOMBAY PRESIDENCY,

FOR THE YEAR

1905-1906.

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No. A/4750 of 1906.

From

H. S. LAWRENCE, Esq., I. C. S.,
Director of Agriculture, Poona;

To

R. P. BARROW, Esq., I. C. S.,
Secretary to Government,
Revenue Department, Bombay,
Poona.

Poona, 5th September 1906.

Sir,

I have the honour to submit herewith the Annual Report of the Department of Agriculture for the year 1905-06 ending with the 31st of July 1906.

CHAPTER I.

Prefatory.

2. I was in charge of the Department throughout the year. Until the 7th of December 1905 I held charge also of the duties of the Director of Land Records and Inspector General of Registration. From that date until the 26th of July I held charge of the Agricultural Department alone and then resumed temporary charge of the combined Departments.

3. Progress has been made with the scheme for the development of the Agricultural Department which was sketched in paragraph 3 of my last report. The detailed proposals made in it are still under discussion with the Secretary of State and the European staff entertained has not yet been increased. In anticipation of sanction, however, two temporary posts of Native Assistant Professors have been sanctioned by Government for Botany, and Mathematics and Physics in the new College of Agriculture.

As described in detail in Chapter IV important steps have been taken towards the institution of this College.

4. Mr. Fletcher was Deputy Director of Agriculture throughout the year until he proceeded home on three months' privilege leave from the 21st of July. The unfavourable conditions of the monsoon of 1905 rendered inconclusive the greater part of the experiments of the farms in his management. Mr. Fletcher prepared a scheme for the survey of alkali lands in the province of Sind which is under consideration, and initiated experiments in the cultivation of the edible date palm in this province.

5. Mr. Knight conducted the Agricultural Course at the College of Science and in addition to superintending the dairy and the farms at Kirkee and Mánjri carried out rice experiments at Lanowli and instituted demonstrations with irrigated cotton and sugarcane cultivation on the Nira canal in the Indápur táluka of the Poona district. Mr. Knight has continued to execute his duties with industry and success. He conducted an useful exhibition of agricultural implements and produce at Ahmadnagar.

6. Mr. Gammie, Economic Botanist, continued in charge of the Ganeshkhind Botanical Gardens and of the Empress Gardens on behalf of the Agri-horticultural Society of Western India. He lectured on Botany in the College of Science and issued a notable publication on the identification of Indian cottons and also observations on Indian wheats. In February Mr. Gammie assumed charge of the new botanical station at Bassein in the Thána district and has made good progress towards its organisation as a botanical garden and has instituted a series of valuable experiments. Mr. Gammie has performed his duties with great zeal and thoroughness.

7. Mr. Meggitt, Agricultural Chemist, has carried out the difficult task of initiating the new laboratory of Agricultural Chemistry and is now instructing, single handed, classes containing over 100 students. With the completion of his temporary laboratory and the arrival of the necessary apparatus and stores and the appointment of some Native Assistants he will shortly be able to commence analytical work.

8. *Native Staff.*—Mr. G. K. Kelkar, Divisional Inspector of Agriculture, Deccan, has been entrusted with a large expansion of duties and responsibilities and has risen to the occasion very satisfactorily. Mr. Kelkar assisted in the teaching of agriculture at the College and in supervising the Poona farm. He toured along the canals in the Sholápur, Poona and the Sátára districts and lectured on sugarcane cultivation and then organised visits of deputations of cultivators to the Mánjri farm. In May he made a survey of groundnut areas in the Deccan and distributed seed.

Mr. S. B. Máhli, Divisional Inspector of Agriculture in Sind, was placed in charge of the Mirpurkhás farm and is reported by the Deputy Director of Agriculture to have worked very satisfactorily amid discouraging circumstances.

In July 1906 Mr. G. P. Bhándárkar was appointed Assistant Professor of Mathematics and Physics in the College and Mr. Hormajshaw M. Chhibber, Assistant Professor of Botany, pending the orders of the Secretary of State on the general scheme submitted for sanction.

9. The subordinate staff was strengthened by the addition of 6 men who obtained the Degree of Agriculture in December 1905.

Three were appointed as probationers under training on the several farms, two were appointed under the Agricultural Chemist, one as his clerk and the other as a probationer, and one as Entomological Assistant under the Deputy Director of Agriculture. It is still important that the Department should not lose the services of any men who may obtain this degree in the course of the next one or two years.

10. The recruitment of posts of the superior and of the inferior native staff is still a matter of great difficulty. In August 1905 Mr. G. D. Mehta, the best agricultural student of the previous year, was despatched to Cambridge University to follow the agricultural course there. Mr. Mehta was given the Sir Mangaldás Nathubhái scholarship by the University of Bombay and Government added a further scholarship of £100 per annum. Mr. Mehta is a Khedával Bráhman of Umreth in the Kaira district and was especially distinguished in laboratory work in agricultural chemistry. In July 1906 Mr. V. H. Gonehalli, who similarly had obtained the Sir Mangaldás Nathubhái scholarship of the Bombay University, was also granted a scholarship and has since proceeded to Cambridge. Mr. Gonehalli is a cultivator by caste from the Kumpta táluka of the Kánara district. It cannot be denied that the experiment of sending students for training in England has had unsuccessful precedents. But in those cases, I am inclined to think, the selection was not wisely made. At the present stage of the development of agricultural institutions in this country it appears to me to be most advisable to send a succession of carefully selected students for further training in England with a view to the production of that superior indigenous agency which must ultimately be the mainstay of agricultural research in India.

11. In the course of the year I visited 17 districts and 2 Native States and in January in company with the European Staff of the Department attended the second meeting of the Imperial Board of Agriculture held at Pusa in Behar.

12. The chief subjects dealt with during the year were as follows:—

(1) Detailed preparation of the plans for the Agricultural College.

(2) Measures for the extension of cultivation of Egyptian cotton in Sind and the disposal of the cotton:

(3) Establishment of a botanical station at Bassein, Thána district.

(4) Establishment of an agricultural station at Dohad (Muwália Tank), Panch Mahálś.

(5) Establishment of a demonstration farm at Bárámati, Poona district.

(6) The utilization of the grant of the Cotton Growing Association for the extension of cultivation of long stapled cotton.

(7) The adulteration and admixture of cotton in Broach.

(8) The cultivation of long stapled cotton under irrigation.

(9) Distribution of selected cotton seed.

(10) The utilization of the Famine Insurance grant for the construction of protective lines of railways.

(11) The areas sown and harvested and outturn of food-grains in 1905-06 in districts of the Presidency affected by scarcity.

(12) The recommendations of the Irrigation Commission regarding boring for water and a sub-soil water survey.

(13) Observations on Mr. Cameron's note on Irrigation Works in the Deccan.

(14) Publication of the proceedings of the Agricultural Conference.

(15) The resolutions passed at the meetings of agriculturists held at the Bombay Exhibition of 1905.

(16) The results of three years' working of the Sewage farm at Mánjri.

(17) The establishment of a Cattle farm at Sholápur.

(18) The transfer of the management of the Northcote Gowshála (cattle farm) at Chhárodi to Government.

(19) Proposals for the re-organization of the subordinate civil veterinary service.

(20) The introduction of the edible date palm into the Presidency.

(21) Experimental Forest plantations in Kánara.

(22) Reports on Price and Statistical Returns.

13. The expenditure of the Department since the receipt of the Imperial subvention of Rs. 3½ lakhs is entered in appendix C, the figures representing the revised budget of 1905-06 and the original budget of 1906-07.

The sum of Rs. 90,000 of the Imperial grant unexpended in 1905-06 has been carried over to the current year. Of this sum Rs. 68,000 were transferred to the Provincial budget owing to the financial difficulties then prevailing. Application has been made for the restoration of this sum, now that the prospects of the year are so favourable.

CHAPTER II.

AGRICULTURAL STATIONS AND SPECIAL INQUIRIES.

14. Last year the stations in charge of the Department were as follows :—

1. Kirkee, Poona, Deccan (General experiments and dairy farm).
2. Mánjri, Poona, Deccan (General experiments, principally sugarcane).
3. Dhulia, Khándesh, Deccan (General experiments, principally cotton and jowár).
4. Surat, Gujarát (General experiments, principally cotton).
5. Nadiád, Kaira, Gujarát (General experiments, principally millets and tobacco).
6. Dhárwár, Karnátak (General experiments, principally cotton and millets).
7. Mirpurkhás, Thar and Párkar, Sind (Cotton and irrigational station).
8. Lonávli, Poona, Deccan (Rice experimental plots).
9. Ganeshkhind Gardens, Poona, Deccan (Botanical research).

15. In the course of the year under report there were opened in addition a botanical station at Bassein in the Thána district and an agricultural station on the Muvália Tank at Dohad in the Panch Maháls district.

The Surat station was also extended for the production of selected cotton seed by the purchase of an additional area of 87 acres at a cost of Rs. 22,245, and on the new area additional farm buildings are in course of construction.

16. At Dohad 58 acres were purchased for Rs. 5,230. The land is commanded by the new Muvália Left Bank Canal. This canal was badly breached by the heavy rains of the previous monsoon. The Irrigational Department

considered the question of abandoning this branch in favour of the Right Bank Canal but finally consented to repair it in order to assist the farm. Owing to the time occupied in discussing the questions involved as to the repair of the canal and the location of the farm the buildings have not yet been completed and cultivation has not yet been begun.

17. At Bassein the site selected is the old Portuguese Fort which within a circuit of 3 miles of battlements contains numerous ruins of fine churches and cathedrals and an area of some 90 acres of very fertile land. The Fort stands on the bank of the Bassein creek looking out to the open sea and at the back has the circle of the Thána hills. It is connected with the Bassein Road station by a good metalled road 5 miles in length and the station is 34 miles distant from Bombay, a 2 hours' railway journey. The soil is typical of the fertile belt of garden land which fringes the coast north of Bombay. The rainfall is certain and good water is available in wells close to the surface. The walls afford protection to the young growth from the violence of the coast winds and the location is not rendered the less suitable for botanical purposes by its picturesque surroundings and historical traditions. This valuable public property was in the possession of the Association of St. John who held it from Government on a tenancy at will. After protracted negotiations it was handed over in February last on payment of compensation for disturbance and for their outlay on the property which was assessed by an arbitration committee at Rs. 12,647.

18. The general equipment of the farms has been further improved. A complete set of implements of cultivation in use in the surrounding tract has been provided at every farm except Mirpurkhás and stands there for exhibition and for comparison with such imported implements as have been proved to be of value. At Dhárwár a well has been constructed for the provision of drinking water to the farm establishment and also of irrigation to the light red soils. A second well is urgently required in the black cotton soil for the protection of the hybrids from destruction in a year of drought such as 1905; but its construction has not yet been sanctioned.

The farm buildings which were under construction last year at Mánjri and Mirpurkhás have all been completed and have proved to be very satisfactory.

19. *Irrigation Problems.*—The Irrigation Commission in their report in 1903 rightly laid great stress on the assistance which this Department should be able to render in the development of agriculture on the new canals projected. The total irrigated area in the Deccan and Karnátak was last year 130,000 acres. The irrigation revenue was Rs. 6½ lákhs and the value of the crops raised was estimated at 86 lákhs of rupees. The Commission recommended the construction of great lake reservoirs in the Western Ghát and of canals leading therefrom to the eastern tracts where the rainfall is precarious and the risk of famine is always imminent, these proposals being estimated to involve the expenditure of some 6½ crores of rupees in the course of the next 20 years. After minute investigation projects have been prepared which, according to the report recently issued by the Chief Engineer for Irrigation, will be capable of placing nearly a million acres under irrigation annually, representing on the basis of the values of crops now irrigated a total annual value of over six crores of rupees. The annual value of the crops is thus almost equal to the capital expenditure required, and may be taken to be three times the value of the present dry crop cultivation in those areas.

20. It is natural that where the cultivator has never before had ample command of water for irrigation, he should make serious mistakes in its application. This is the experience not only of Sind and the Deccan but also of Upper India; and even in Egypt, where we are told to look for agricultural skill and enlightenment, Lord Cromer notes the prevalence of similar mismanagement. Everywhere the cultivator is inclined to flood his land excessively in ignorance of the misfortunes which he is preparing for himself; in the water logging of his land, where the drainage is deficient; in the growth of saline efflorescences

where the soil is impregnated with alkali; and in the deterioration of the fibre of his cotton or the grain of his cereals. Further he necessarily lacks experience of the more valuable crops which the canal will enable him to substitute for his ordinary dry crop cereals.

21. The Mánjri farm has already made valuable discoveries for the benefit of the cultivator on the canals of the Poona district; and the Mirpurkhás farm in Sind and the Dohad farm in the Panch Mahál will similarly serve those areas. But these three farms alone have full command of irrigation, and the necessity of creating additional stations where canals have lately been constructed or are now projected is recognised.

It is desirable that as soon as men and money are available farms should be established on the existing Gokák canal in Belgaum, and the Krishna canal in the south of Sátára; and in anticipation of the advent of the Nira Right Bank canal in the north of Sátára and on the Godávari and Pravára canals in Ahmadnagar.

Further in Sind the existing farm at Mirpurkhás represents the conditions of the central belt but, apart from differences in the soil which are at present unknown, there are considerable differences in the temperature and climate of Upper and Lower Sind notably in the greater heat and cold of Northern Sind and in the effects of the winter fogs of Southern Sind. It is important that as soon as possible additional farms should be instituted in the neighbourhood of Kandiáro in the north and Badin in the south.

22. A detailed account of the experiments on the existing farms has been published in the Annual Report on the Agricultural Stations in the Bombay Presidency which is on sale at the Government Book Depôt, Bombay. A summary of it is attached as appendix A to this report.

In my report of the last year I explained briefly the principal objects of these experiments; and it is unnecessary to repeat the explanation.

In the current year experiments have been made at the instance of the Government of Bengal in the growth of Jute, which, in the opinion of the Bengal Jute Expert who was deputed to inspect them, give promise of success in some localities.

A subject to which little attention has yet been given on our stations is the cultivation of oil-seeds. The value of varieties grown in different localities varies greatly, and it should be possible to introduce superior varieties from one tract to another.

23. The necessity, with the small staff at our disposal of economising the energies of our officers and concentrating their efforts on a limited number of definite investigations, has been impressed upon us by the Board of Agriculture, and requires constant consideration. I desire to express my acknowledgments to the Imperial staff at Pusa for the assistance derived from their criticisms and advice on the operations of this department. Much yet remains to be done in determining the programmes of work on our new farms, and in co-ordinating the duties of the several officers so as to prevent duplication of effort. In the settlement of such questions which are frequently of considerable technical difficulty and which sometimes affect the personal relations of individual officers, the advice of the Inspector-General of Agriculture and the central staff is most valuable.

24. *Cultivation of Egyptian cotton in Sind.*—In my letter No. C—44 of May 19th I reviewed the position of affairs and I attach extracts therefrom as appendix B to this report.

In regard to this year's cultivation I learn that in the Jamesabad táluka the crop is flourishing but on the more saline lands of the Mirpurkhás táluka it is not doing so well. The allegation has been made that the cultivators did not receive a sufficient price for their produce but, in the circumstances explained in the appendix, the prices obtained appear to be very fair. A further important fact has since come to my notice. Between January, when the cotton was purchased from the cultivators, and April, when it was sold in Liverpool,

Egyptian cotton had risen greatly in price. I quote below the figures obtained in Liverpool on January 5th and May 5th:—

	Abassi.	Metafifi.	Mid-American.	Sindhi.
	d.	*d.*	*d.*	*d.*
January	9	8½	6¼	4½
May	10⅝	11¼	6⅛	4⅝

In regard to the coming season the Commissioner in Sind has expressed the opinion that several firms in Karáchi will enter the market and that mutual competition will result in raising the standard of prices as high as possible. I anticipate also that the Ahmadabad mill-owners will be competitors for the supply, for in June in company with Mr. Mead I had an interesting discussion with them at a meeting, in which they expressed their intention of sending up representatives and establishing their own cotton-gins in the tract.

CHAPTER III.

Entomology and Mycology.

25. In my last year's report I noted that a few swarms of locusts were observed in March and April 1905 to issue from the Konkan forests in diminished numbers. In June and July these swarms laid their eggs in the forests of Ratnágiri and Khándesh and on the borders of the Central Provinces. In October the new adult brood traversed the country but in comparatively few swarms. They again wintered in the Konkan, Goa and Sávantvádi. Their numbers were further reduced by their natural enemies (I am told that in Goa tigers were observed to devour them when torpid with cold in the early morning) and in the spring of 1906 very few swarms issued and visited the districts of Dhárwár, Belgaum, Bijápur, Sholápur and Khándesh.

Apparently the pest has now been reduced to its normal dimensions and it is improbable that any serious recrudescence will occur until the climatic conditions are repeated which led to the enormous increase of swarms in 1883 and 1884 and 1903-04. What these climatic conditions are is a question which still awaits elucidation by the Entomologist. Its solution may appear to be of mere academical interest in the absence of means for checking the plague. It is of little use to receive a warning that the plague is imminent if we cannot make use of the warning to defend ourselves against it.

When the recent plague first attracted serious attention in the spring of 1904 no definite knowledge was possessed of the nature and extent of the danger. The swarms were then in flight. We have since learnt that at this stage no useful action can be taken but at the time suggestions were heard of utilising the full strength of the civil administration and even calling in the troops to destroy the swarms. These suggestions were probably based on a mistaken analogy with the measures taken in Cyprus.

26. In order to guard against similar misconceptions in future I venture to emphasize certain of the different features attaching to the Bombay problem. Nowhere except in South Africa has success been claimed in the destruction of the winged swarms and in such matters claims advanced from South Africa merit careful scrutiny. Elsewhere it is only when the young brood is in the hopping stage and, having assumed the gregarious instinct, is marching across the country, that they can be driven into trenches or destroyed by mechanical means such as American Hopper-dozers.

But in Bombay with the distinctive species (Acridium succinctum) of which we are the chief unfortunate possessors the gregarious instinct is not developed until the locust begins to fly. The young brood is found in small patches of land scattered about on the hill sides of a wild region which is sparse-

ly inhabited and which is exceedingly difficult of access at any time of the year, and practically impossible of access during the months of September and October when the heavy rains are falling. In these circumstances all that can be done in our present stage of knowledge is to palliate the evil by the employment of the hill-tribes, whose crops are first devoured by these hoppers, on the destruction of their enemies. To some slight extent the pest is then diminished and the chief sufferers therefrom are at the same time recompensed.

27. The problem however demands the earnest attention of the Entomologist. The fungus disease recommended from South Africa has been tested without success both by district officers in various parts of India and by the Bacteriological laboratory at Muktesar. But it is desirable that further experiments should be made before it is entirely condemned as a South African myth.

Apparently the chief enemy of the Bombay locust is the tachinid fly which is capable of reproducing itself with astonishing rapidity and of parasitizing and destroying a whole swarm of locusts in a brief period. In the future, when an invasion of locusts is apprehended, it may be possible to breed this parasite and let it loose in the swarms. However this locust problem is not confined to Bombay or India. It is met with in the north-east of the United States, in South and North Africa and Russia, and it is possible that before the pest troubles us again science may have found a means of defence. Nevertheless it would be a most important duty for the Entomologist of this Department (when the appointment of such an officer is sanctioned) to study the discoveries of foreign investigators and adapt their methods to the divergent characteristics of the Acridium succinctum.

28. The most destructive enemy of agriculture in this Presidency more especially in the sandy soils of Sind and Gujarát is the *white ant* (Termes lucifugus).

When the rains are plentiful in Gujarát the ravages of this pest are diminished and it is largely to destroy this pest that the Sindhi cultivator floods his fields and is anathematized by the Irrigation Department for wasting their water and by the Agricultural Department for damaging the quality of his cotton fibre and his wheat grain. If a practical remedy within the means of the cultivator could be found the agricultural wealth of the northern provinces of Bombay would be immensely increased.

29. *The American Cotton Boll Weevil.*—The spread of this plague in America was first brought to my notice by Mr. Lefroy, Imperial Entomologist, in January last. I drew the attention of Government to the American reports which showed that within a few years the pest had traversed an enormous tract of country and in 1905 was computed to have caused the loss of cotton to the value of 22 million dollars; while the American Entomological Department itself expressed the apprehension that it would shortly invade other countries through the medium of American exports of seed. With the support of the Agricultural Conference which was held in Bombay in February and of the Chambers of Commerce of Bombay and Karáchi this Government addressed the Government of India and obtained the issue of a notification in July last prohibiting the importation of cotton seed from America or the West Indies which had not been fumigated to the satisfaction of the Collector of Customs. Arrangements have been made for the conduct of such fumigation by means of bisulphide of carbon.

The most serious feature of this pest is its impossibility of detection. The weevil lays eggs in the immature boll and the minute puncture becomes invisible almost at once: the boll remains seemingly sound while its heart is being eaten up by the developing larva within. A strong section of the Entomological Bureau of the United States has been attempting in vain to combat this pest and check its progress and the pessimistic prophecy is heard that the whole cotton industry of America is doomed to extinction in time by its ravages.

It is to be hoped that the precautions taken by Government will prove effectual and that this most serious danger may be averted from the cotton industry of India.

30. *The Cotton Borer.*—Several varieties of this pest are always to be found in the cotton crop of every part of the country but in the last season the *Earias insulana*—the pest which is causing such havoc in Egypt—caused unprecedented damage to the crops in the Punjab and Sind. The outturn in the Punjab was reduced by more than one half.

The cause and prevention of this pest deserve very thorough investigation. I learn that owing to the fear of its repetition much land on the Jamrao Canal in Sind recently placed under cotton is this year placed under cereals and if it maintains its hold in Sind it will undoubtedly check the introduction of Egyptian cotton in that province.

31. These are only a few of the more important pests; but there is in my opinion no branch of agricultural work which affords such promise of valuable results to the country as entomology.

Even the most skilful cultivators are profoundly ignorant of the life history and habits of insects. Beneficial insects are mistaken for injurious insects and are destroyed; injurious insects which hatch out from eggs laid in their fields are believed to come in a night as a visitation from some incensed deity and no attempt is made to find and destroy the eggs. Instances could be multiplied but I need mention only the destruction by rayats of the lady-bird, *Hippodamia maculata*, which is supposed to eat jowári, but in fact feeds on the aphides which are attacking the jowári; and the incredulity of the rayat when first shown the eggs of the locust and the Belgaum grass-hopper.

The scientific study of insect life is a new idea to the Eastern mind, and progress therein must, for some time, depend on imported expert observers.

32. *Mycology.*—Investigations of the diseases of groundnut and tur are being conducted at the hands of Dr. Butler, the Imperial Mycologist at Pusa. As regards groundnut Dr. Butler considers the disease to be communicable both by seed and by soil infection, and recommends the cultivation of an early variety, since as a rule the disease gains ground late in the monsoon season. Three varieties, Spanish pea-nut, Virginia, and Pondicherry, have been specially selected by the Deputy Director and three tons of seed of the latter variety have been distributed in the season now current.

As regards the wilt disease of tur the selection of resistant varieties is proceeding with some success on the Poona farm.

It is to be hoped that the Presidency will be enabled before long to take its share in Mycological research in which rapid progress cannot be expected when one single officer at Pusa has to deal with the problems of the whole continent of India.

CHAPTER IV.

Agricultural Education.

College of Agriculture, Poona.

33. The organisation of the College of Agriculture is in my opinion the most important part of the work now in progress in this Department. On the provision of sound agricultural teaching in this College we depend for the supply of the Native Staff who must carry out our experiments and interpret their results to the people. At the present moment the development of the work of the Department is checked in every direction by the want of trained subordinates. But the position for the future is now promising. Whereas in 1902-03 there were 27 students studying agriculture, there are now 113.

The strain on the teaching staff is very great; but Messrs. Knight, Gammie and Meggitt have responded to the demand very thoroughly and the instruction continues to be satisfactorily efficient. In the Agricultural branch of teaching Mr. Kelkar and Mr. Patil have been appointed to assist Mr. Knight. In July Mr. H. Chhibber was appointed Assistant Professor of Botany and Mr. G. P. Bhándárkar, Assistant Professor of Mathematics and Physics. It has not been found possible, in spite of enquiries made in other provinces of India,

to find any person qualified and available for the post of Assistant Professor of Agricultural Chemistry. In the scheme recently submitted for sanction to the Secretary of State provision is also made for the post of Assistant Professors in Entomology and Mycology. It is proposed that all these posts should start on Rs. 200, rise by biennial increments of Rs. 30 to Rs. 350, and then by selection to Rs. 400 and Rs. 500.

Land and Buildings for the College of Agriculture.

34. The site selected on the Ganeshkhind road of 143 acres has been purchased and taken possession of. The sum awarded by the Assistant Collector is Rs. 56,200; but the award is in dispute and under reference to the District Court. A Committee consisting of Mr. Giles, Director of Public Instruction, Mr. Hill, Secretary to Government, and myself considered and prepared plans for the future development of this estate. These were referred to the Consulting Architect Mr. Begg and the preliminary sanction of Government was obtained to the construction of the main College building at a cost of Rs. 3,58,000, the Chemical and Physical Laboratory at a cost of Rs. 1,25,000, residences for one Professor and two Assistant Professors at a cost of Rs. 39,000, in all Rs. 5,22,000. The detailed plans and estimates are still under preparation by Mr. Begg, but skeleton plans have been received. The roads are being constructed and the foundations of the two principal buildings have been commenced. The area, which is to form the College farm, is also already utilised for the practical instruction of students by Mr. Pátil.

Meantime, since the College of Science contains no accommodation for the present large class of agricultural students and since it is desirable to separate the two Colleges at as early a date as possible, two bungalows have been hired immediately adjoining the Kirkee dairy farm. Laboratories have been prepared for the Agricultural Chemist and the students of his class and lecture halls have been provided for separate lectures in all agricultural subjects. It is expected that with the commencement of the new College year in January 1907 the College of Agriculture will assume a separate corporate existence.

35. The Training Colleges at Ahmadabad, Dhárwár and Hyderabad, where village school masters are instructed in the art of pedagogy, have attached to them small demonstration plots where they can learn to apply to their object lessons in village schools the results of their observations in agriculture. These farms are being satisfactorily managed by teachers who were recently trained in this Department. Masters of the Poona College are now being similarly instructed on the lands recently purchased for the College of Agriculture and now under cultivation as demonstration plots.

36. The Agricultural Lessons for the rural schools prepared by Mr. Knight have now been finally issued and distributed. Mr. P. R. Mehta's Hand Book on Agriculture has also been prepared and issued. The latter work is issued in English and is being translated into the vernaculars by private enterprize.

37. The annual class for the instruction of junior Civilians in elementary knowledge of agriculture was held by Mr. Knight in September and October 1905. I am aware that some of these officers find agricultural science to be distasteful and some consider it unworthy of much attention; but I attach considerable value to the instruction given. In some cases it has awakened a genuine interest in the possibilities of the improvement of agriculture, and in all cases it has dispelled much ignorance and rendered even the reluctant recipient better fitted for his out-door work as Assistant Collector. I have known cases where remissions of revenue have been recommended on the ground of the loss of a crop of groundnut where the crop which had merely ripened was mistaken for one which had withered and cases where remissions were actually granted on rice crops which had been set back by a flight of locusts but had not been damaged and ultimately gave a full outturn. Further the young officer, who knows some thing about the crops, will find a ready road to the confidence of the rayat, while the officer whose conversation is limited to questions regarding boundary marks and birth and death registers would find his remarks persistently misunderstood and his village inspections a source of profitless annoyance both to himself and to the rayats.

CHAPTER V.

Publication of Agricultural Information.

38. The annual Season and Crop Report has been separately published containing the agricultural statistics of the Presidency, and the preliminary and final forecasts on wheat, cotton, sesamum, groundnut, linseed and rape-seed have been issued from time to time.

39. A fresh distribution was made of the leaflets, which were prepared and distributed last year, *e. g.*, on Egyptian Cotton and Irrigated Cotton in the Deccan and Karnátak (revised in the light of the experience of the last year). A leaflet on the grass-hopper pest of Belgaum was written by Mr. Knight and translated and distributed.

An important bulletin on Cotton was prepared by Mr. Fletcher and will be issued in a short time. In this bulletin a detailed survey is made of the various species of cotton grown in this Presidency, and of the different lines on which attempts to secure their improvement must proceed. It represents the result of a careful study of the question by a competent observer for a period of three years and should prove to be of great interest to all concerned in the cotton industry.

A bulletin on the edible Date Palm has also been prepared by Mr. Fletcher and is being issued both by the Reporter on Economic Products to the Government of India and by this Department. After protracted but somewhat hap-hazard experiments throughout India the conclusion is that the only prospect of the successful cultivation of this palm is to be found in the rainless tracts of North-Western India, of Sind and the Punjab.

A memoir on the Bombay Locust issued by Mr. Lefroy under the title of "Memoirs of the Department of Agriculture in India" (Entomological Series), Vol. I, No. I, incorporates the results of the observations made by Mr. Knight and the periodical reports submitted by this office to Government.

40. The suggestion is frequently made that the Department should send out Itinerating Instructors, and I entirely concur in the desirability of adopting this system as soon as we have a trained staff competent to perform this difficult duty. It is already the recognised duty of each Superintendent of a farm to visit the villages within easy access of his farm and advise the rayats. The task however requires not only experience but judgment and more harm than good would result from sending out on this mission unsuitable men.

With the assistance however of the allotment of three and a half lakhs of rupees per annum from the Government of India we are now preparing for a wide expansion of the Department and before many years are past hope to be in possession of a competent and trained staff of native subordinates. The good reputation of the management of the farms in this Presidency is due chiefly to the excellence of the training which Mr. Mollison, now Inspector-General of Agriculture, gave to his subordinates. But as these men are promoted to spheres of wider responsibility it is a difficult task to maintain the standard of work on the farms (and on the care and accuracy of the detailed work of the farm the results of all our experiments must depend). An agricultural station, where the work is slovenly and the results are untrustworthy, is not only useless but actually mischievous. For these reasons it is necessary for the Department to withstand the well meaning demands of our friends that we should establish immediately experimental and demonstration plots in every district and send forth Itinerating Instructors by the score.

41. But a beginning has already been made. Mr. Kelkar, the Divisional Inspector in the Deccan, toured on the Krishna Canal in the Sátára district, the Mutha and Nira Canals in Poona, and the Ekruk Canal in the Sholápur district, and at the request of the Collector of Belgaum made a special inspection of the estates of several important Jáhgirdárs in that district.

He reports that his lectures on the subject of methods of irrigation and of manures were listened to with much attention and the impression which

he made upon the more intelligent Kunbis was shown by their readiness to leave their villages at his request and visit the Mánjri farm for the study of sugarcane cultivation there in February and March last. The expenses of these men were paid and they were entertained at the farm for a couple of days. They showed the greatest interest in all that they saw and cross-examined the farm staff very thoroughly. This step may I think be repeated and I am confident will have excellent results in spreading the influence of the farm.

Mr. Kelkar's report on the Jáhgir estates was distributed to Collectors in the Deccan and Karnátak with the offer of his services in advising on the agricultural management of other estates under the Court of Wards. Such estates could with advantage be utilised not of course for experiment but for the demonstration of new crops and agricultural improvements.

In the Dhárwár district also Mr. Kulkarni, Superintendent of the farm, visited many villages and established touch with the leading agriculturists. He had however less scope for lecturing than Mr. Kelkar; for except as regards implements the Dhárwár farm has yet more to learn than to teach.

42. An Itinerating Inspector has also been appointed to supervise the cultivation of irrigated cotton in the Deccan. Mr. Káshinath Shinde, who had been in charge of the Mánjri farm for some 10 years, has been appointed to this post. Irrigated Broach cotton has been grown for three years now at Mánjri and has given on an average an outturn valued at over Rs. 50 per acre. In 1905 seed for 600 acres of cultivation under canals was issued from the Surat farm. The instructions were to a great extent ignored and the crop was grown in some cases even as a dry-crop and the percentage of failure was very great. In order to ensure greater attention to the instructions Mr. Shinde was placed on special duty early in June and supervised the sowing of the greater part of the current year's crop. Several years however will be required to spread an accurate knowledge of the methods necessary but our experience at Mánjri warrants the anticipation of ultimate success.

43. For the same purpose a demonstration plot has been established at Bárámati in the Bhimthadi táluka. This town is the centre of the cultivation on the Nira Left Bank Canal. Five acres of land have been placed under irrigated cotton and it is hoped that the cultivators, who reside at Bárámati, will learn the correct methods of cultivation by actual observation.

44. An important Agricultural Conference was held in Bombay on February the 5th and 6th. It was presided over by the Honourable Mr. Muir Mackenzie, C. S. I., Member of Council, and was attended by representatives of the Chamber of Commerce of Bombay, the Mill-owners' Association, Agri-Horticultural Society of Western India, Dhárwár Agricultural Association, and the Bombay Natural History Society and 19 merchants and land-holders and 10 Government Officers of the Agricultural, Veterinary and Forest Departments. The proceedings of the Conference have been published in a blue book which is for sale at the Central Book Depôt, Bombay.

45. Agricultural exhibitions on a small scale were held at Ahmadnagar in October 1905 and at Ahmadabad in March 1906 in connection with the horse and cattle shows.

46. The Dhárwár Agricultual Association has commenced to do useful work in the trial of special varieties of seed and manures. It is fortunate in having as Secretary Mr. Kulkarni, the Superintendent of the Dhárwár farm, who is the main spring of its vitality. No new Agricutural Associations have been founded. When the interest of such Associations is not stimulated by the constant assistance of a trained officer they are liable to lapse into apathy and stupor or even to be diverted to extraneous purposes. It is not desirable that rayats should be invited by Government officers to join an Agricultural Association and to subscribe their money and that when persuaded to attend meetings they should be entertained with harangues on the increasing poverty of India, the tyranny of the Forest Department, and such other subjects appropriate to a Congress platform but wholly foreign to the improvement of agriculture.

Attempts to pervert the object of agricultural meetings have been made in more than one instance in this Presidency. It is important therefore that every Association should consist of carefully selected members, that the proceedings

should be guided by the District officers and that a genuine programme of agricultural work should be placed before them by an agricultural expert having experience of local conditions. When we have separate Deputy Directors for Sind and the Presidency and when we are able to send out Itinerating Instructors we may safely look for a considerable expansion of Agricultural Associations.

47. So also as regards the Central Agricultural Organisation Society which we are sometimes asked to establish at once, I would invite reference to the experience of the Agricultural Society of Egypt of which Lord Cromer in his Report No. 1 of 1905 has stated that "the Central Administration of the Society has not been sufficiently in touch with the small cultivators" and that in order to maintain relations between the Central Society and the provincial delegations it was necessary to "nominate young Egyptians who have obtained the Diploma of the School of Agriculture as Secretaries to the Delegations." Lord Cromer further wrote "The main difficulty for the moment has been to find the requisite personnel to start the new system. Its success will depend largely on whether capable and well informed men are to be found to act as Secretaries to the Delegations. Only three Moudiriehs (districts) have been so far provided with Secretaries. Suitable Secretaries for other Moudiriehs are not at present available. As soon however as an additional number of young Egyptians can be trained for the post, delegations will be appointed to other Moudiriehs. In the meantime the Society has engaged students possessing a Diploma in Agriculture to undergo the necessary training." It is clearly necessary for us also to avoid undue haste and to adopt the same cautious method of advance.

48. We already possess the nucleus of this system in the Agri-Horticultural Society of Western India and, when Itinerating Instructors are available, it will be possible to link up the Central Society with District Associations. In the meantime the whole strength of the Department is employed to its extreme limit in organising the new College of Agriculture, in administering the new agricultural stations and farms which have been established in recent years, and in maintaining the efficiency of the standard of experiments through the agency of a newly recruited and largely increased staff of inexperienced assistants. Any further rapid expansion of their duties and responsibilities would infallibly lead to the dissipation of their energies in thin air.

49. The awakening of public interest in agriculture and in the work of this Department is evidenced by the numerous offers which we have received from land-holders of placing land at our disposal for the conduct of experiments and demonstrations. When we have the men to cultivate these plots we shall be able to establish numerous demonstrations in the country and spread the influence of our improvements over a wide area.

I have the honour to be,
Sir,
Your most obedient servant,

H. S. LAWRENCE,
Director of Agriculture.

APPENDIX A. (*Vide* para. 22.)

Operations of the Agricultural and Botanical Stations of the Bombay Presidency.

The Surat Station.

Surat—Established in 1896; *North Latitude* 21° 12′; *East Longitude* 72° 52′; *Height* approximately sea level; *Soil* Black Cotton; *Average rainfall* 39″ 31″; *Temperature* Maximum 103° in May 1905, Minimum 47° in January 1906.

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall—	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
(1905-06)	0 0	0 0	1 0	16 49	1 0	1 10	0 0	0 0	0 0	0 0	0 53	0 0	19 82
Average ...	0 0	0 0	9 04	13 08	9 08	7 03	1 04	0 01	0 01	0 0	0 0	0 0	39 31
Temperature (1905-06)—													
Mean maximum ...	88°	93°	89°	85°	85°	86°	88°	84°	79°	79°	77°	87°	
Mean minimum ...	72°	84°	86°	75°	79°	78°	80°	73°	66°	64°	66°	74°	

Area.—84 acres arable and 150 acres pasture.

Superintendent.—Mr. Bhimbhái Morárji Desái.

2. The *season* was very unfavourable. 16½ inches of rain fell in the month of July and less than 3½ inches in the rest of the year, while the average rainfall is 40 inches. In such abnormal circumstances no trustworthy conclusions can be drawn from the experiments.

3. The principal *crops under experiment* were:—Cotton, jowári (Andropogon sorghum), tur (Cajanus indicus), til (Sesamum indicum), groundnut (Arachis hypogæa) and lucerne (Medicago sativa).

4. *Cotton-breeding* is now the chief object of this farm. Mr. Fletcher reports:—

"The hybrids were only kept alive by giving one or two waterings. It is impossible therefore to safely estimate the progress made but it may be stated that one cross (1027A) has been valued as high as nearly 20 per cent. above the ordinary growth of the district and this superiority was also shown last year. A normal monsoon cannot fail, I think, to show that a real improvement has been obtained in the case of this, if in no other hybrid."

5. *Manurial experiments* were conducted with sodium nitrate, crude nitre, oil-cakes, farm-yard manure, dissolved bones, gypsum, superphosphate and sulphate of ammonia.

As has been observed before, it was found that in a year of deficient and ill-distributed rainfall, the application of manure was actually injurious. Mr. Fletcher explained the similar result obtained last year as follows:—

"This apparent anomaly is in reality no more than could have been foretold and is easily explained by the fact that the organic matter contained in the soil of the manured plots both retained the slight rainfall near the surface of the ground where part of it was rapidly evaporated, and also held the remainder with such force that the roots of the plants could not abstract so large a percentage of moisture from the soil as was possible in the case of unmanured plots which naturally contained a less amount of organic matter. Owing probably to the first of these methods of action cotton being deep-rooted has suffered more than the shallow-rooted jowár."

6. *Rotation Experiments.*—Mr. Fletcher notes that in a year of scanty rainfall, jowári does not give good results if it follows cotton.

7. *Green Manure.*—On this subject Mr. Fletcher writes as follows:—

"On account of want of sufficient rains, the crops intended for green manure totally failed and could not be ploughed in. Green manuring is only practised on light gorádu soils in good condition where the crops grow very quickly and can be ploughed in early. But on the black cotton soils the crops take a very long time to attain sufficient height for ploughing in, so that they do not rot properly in the soil and that afterwards winter crops cannot be sown. Consequently the experiments are abandoned in next season's cropping scheme."

This is an important conclusion and should be based on observations of a normal year. The experiment should, therefore, be resumed and studied further. The discovery of a leguminous green manure which would grow on black soil in the early part of the monsoon would be of great value.

8. The series of permanent rotation and manurial experiments laid down by Mr. Mollison in 1897-98 were abandoned by Mr. Fletcher in consequence of the errors reported by him in the previous year. The question was discussed by the Board of Agriculture in January 1905, without any definite conclusion being arrived at. Mr. Mollison on his return from Europe will no doubt examine it further.

9. The results of this year's work are summed up by Mr. Fletcher as follows:—

"The monsoon not being normal little of practical importance can be deduced from these results which in a normal year would, doubtless, in many cases be reversed."

It is noteworthy however that

(1) the unmanured plots have yielded best (excepting always the plots that were last year fallow);

(2) both cotton and jowári have, on the average, yielded worse after jowári than after cotton.

The second inference is not consistent with that recorded in paragraph 6 above.

10. The cultivation of groundnut under irrigation was satisfactory; the yields varied from 2,200 to 3,800 lbs. of unhusked nuts per acre, valued at Rs. 140 to Rs. 240. The best varieties were Virginia, Japanese (big) and Pondicherry. This crop has been very little cultivated hitherto in Surat; and the cultivators if they take it up must determine for themselves which variety will suit best the special conditions of their lands; for each has special advantages and disadvantages, *e. g.*, the cost of harvesting is lowest in the case of Spanish peanut and Japanese (small) and greatest in the case of the indigenous variety. On the other hand the latter is less exposed to attacks of pigs, jackals and birds. In this year's crop the indigenous also commanded a higher price but contained only 47½ per cent. of oil against 51½ per cent. in Spanish peanuts.

11. *Irrigation experiments* with lucerne corroborated the experience of Poona that cultivation on ridges is superior to cultivation in beds.

12. The following inferences drawn by Mr. Fletcher in regard to irrigation on black soil are of interest:—

"Crops grown, *e. g.*, groundnut, lucerne, &c., on thin black soil in beds or in ridges require the equivalent of 5″ of rainfall for the first watering, a month or month and a half after the rains stop, and for each subsequent watering the equivalent of 2″ to 3½″ of rainfall. In the case of lucerne the equivalent of 3″ of rain for monthly waterings and of 2½″ for waterings at intervals of 15 days is required.

"In the case of drilled cotton two to three months after the rains cease when the soil has not cracked as badly as it does later, the first watering requires water equal to about 7″ to 8″ of rainfall and the subsequent waterings at intervals of 20 days require the equivalent of 3½″ to 4″ of rainfall.

"And lastly a fallow area which has fully dried up after the rains if required to be flooded as in canal irrigation, requires irrigation equal to 14″ of rainfall. It appears that at the break of the monsoon it takes about half an inch of rainfall to saturate each inch of the soil at least for the first foot."

13. *Local Demonstrations.*—Nitrate of soda and nitrate of potash applied to irrigated rice in the fields of a cultivator gave a satisfactory increase of yield. A similar demonstration in the case of sugarcane was inconclusive.

14. *Dairy Herd.*—The account is incomplete. In accordance with the orders of Government the herd was reduced in number and now stands at 61 head against 108 on April 1st 1905. The question whether it serves the purposes desired should be re-examined from time to time.

15. *Distribution of Seeds and Implements.*—9,000 lbs. of cotton seed were despatched for cultivation under irrigation in the Deccan and the Karnátak. Samples of various seeds were sent to several Provinces of India. Bengal took a considerable number of drills, ploughs and harrows.

The farm was visited by 140 visitors, of whom two-thirds were non-officials. The Superintendent visited several villages in the district and managed an agricultural exhibition which was held in March 1906 in connection with the horse show at Ahmadabad. Seven probationers were under training on the farm.

16. The net cost of the farm was Rs. 8,504, the gross outgoings being Rs. 10,950 and the receipts Rs. 2,446. The sale of the farm crops obtained only Rs. 1,368.

The Nadiád Station.

Nadiád.—Established in 1903; *North Latitude* 22° 44′; *East Longitude* 72° 0′; *Height* approximately sea level; *Soil* Alluvial Loam (Vern: Gorádu); *Average rainfall* 32′ 85″; *Temperature* Maximum 114° in May 1905, Minimum 50° in January 1906.

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall—	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
(1905-1906)	0 0	0 0	1 40	26 57	0 21	2 81	0 0	0 0	0 0	0 0	0 10	0 0	31 09
Average	0 05	0 17	4 54	12 65	9 91	4 22	0 64	0 44	0 04	0 03	0 12	0 06	32 85
Temperature (1905-06)-													
Mean maximum ...	99°	110°	101°	91°	94°	91°	95°	89°	79°	80°	79°	93°	...
Mean minimum ...	75°	86°	86°	80°	81°	80°	77°	68°	60°	57°	63°	69°	...

Area.—44 acres.

Superintendent.—Mr. Dattátraya Hari Tagáre.

18. The *principal objects* of the station are to investigate—

(1) Local methods of cultivation, rotation and fertilising.

(2) The cultivation of tobacco.

(3) The introduction of a cotton suited to the district.

(4) The introduction of artificial fertilisers.

(5) The control of insect pests, in particular white ants.

19. The chief *crops grown* were tobacco, cotton, millets, pulses, rice, wheat, castors, sugarcane, chillies, guvár (Cyamopsis psoralioides) and sheria (Hibiscus subdariffa).

The *fertilisers used* were farm-yard manure, castor cake, nitre, sodium nitrate, ammonium sulphate and san (Bombay hemp) as green manure.

20. The *season* was very unfavourable. Of the 18 inches of rainfall received 11 inches fell in one day in July and did great damage. No conclusions of value can be based on the year's results.

21. *Tobacco.*—Observations have been recorded on the effects of nitrate of soda and potash, castor cake and green manuring and of deep and shallow ploughing. A number of foreign varieties were tried (Spanish, Java, Havana, Sumatra, Florida, Tuloan) and several produced leaves of a promising character.

22. *Cotton.*—(*a*) Broach cotton was cultivated but the outturn was poor.

(*b*) Rozi cotton (Gossypium obtusifolium) was destroyed by the heavy rain.

(*c*) American sown in April was attacked by boll-worm and failed.

(*d*) Egyptian sown in February was attacked by white ants and failed.

(*e*) Dharwar-American gave some promise of success.

23. *Cotton-breeding.*—A successful beginning was made with hybridisation.

24. *Brinjals* (Solanum melongena).—No results were noticeable from applications of nitre and sulphate of ammonia.

The alleged effect of sulphate of ammonia on white ants as reported from Dhulia should be investigated at Nadiád.

25. *Rice.*—Unirrigated failed; irrigated was vitiated by the season.

26. *Jowári* (Sorghum).—The local varieties produced grain; the foreign failed.

27. *San* (Crotolaria juncea), which is unknown in this locality, grew well and may prove useful as a green manure.

28. *Rotation experiments* were commenced with cereals, pulses, oilseeds, fibres, spices and sugarcane. The outturn of cereals was for the most part only some 500 to 700 lbs. of grain per acre. The sugarcane was destroyed by attacks of the borer and of white ants; and chillies suffered severely from the latter pest and from frost.

29. *Cultural operations* were vitiated by the season.

30. *Insect Pests* were very severe, probably owing to the scanty rainfall. The following observations are recorded by the Deputy Director :—

"*Brinjal Borer.*—(Leucinodes orbonalis).—In the month of September borers were detected in the brinjal crop. As soon as the crop is attacked the growing shoot of the plant withers. If the withered shoot be cut the borer is found. All the affected plants were removed and burnt.

Sugarcane Borer.—(Chilo simplex).—The attack of the borer was detected in the month of August when the sugarcane crop was very young. All the affected shoots were cut down and burnt. Maize was also sown to attract them. A second attack was detected in November, when it was not possible to cut down all the affected plants. This attack was very severe.

Red Cotton Bug.—(Dysdercus cingulatus). These insects were seen sucking the bolls of American and Egyptian cotton in August.

They were picked and destroyed in kerosine oil.

Wilt Disease.—Several plants of cotton were attacked with this fungoid disease. Specimens were sent to Dr. Butler, the Imperial Mycologist, for identification. The affected plants were removed and burnt.

Scale Insects.—A few castor plants were attacked with scale insects in October. The affected leaves were plucked and burnt.

White Ants —The greatest enemy of the valuable crops in these sandy soils is white ants. During the last season great damage was done by this pest to sugarcane, chillies, tobacco, &c. Attacks are specially severe in years of light rainfall."

31. *Irrigational Experiments.*—Observations were recorded as to the irrigation given to various crops. In order to enable any useful conclusion to be drawn regarding the water requirements of each crop account should be taken of the rainfall received.

32. *New Implements.*—The Deputy Director mentions a winnowing fan apparently as having worked successfully on the farm. The cost is not mentioned, but if it is not prohibitive, it should be in demand in a district like Kaira where the cultivators attach some value to time. Arrangements should be made for its exhibition and distribution. The turn-wrest plough which is highly approved of in the black soils of Dhárwár is not equally suitable to the alluvial loam of Kaira.

33. *Local Demonstrations* in regard to the value of nitrate of soda as a tobacco fertiliser did not prove successful in the circumstances of this year.

34. *Oil-Engine and Pump.*—The Deputy Director reports as follows :—

"The engine was found not to be able to work continuously, and after much investigation I decided to exchange the original 4" pump for one of 3". This has now been installed and the engine now works regularly 7 hours a day and could work longer if required. In this period (7 hours) it raises 7,350 cubic feet of water through a mean height of 57 feet and this will irrigate 48 gunthas of ordinary crop (36 gunthas of sugarcane). To raise the same quantity of water by bullock power in a whole day would require 4½ pairs of bullocks and 9 men. If raised in this manner the water would irrigate only 36 gunthas of ordinary crop owing to the slowness with which it is applied.

There are then two ways of comparing the bullock "kos" and the engine, *viz* :—

(*a*) by quantity of water raised,

(*b*) by area irrigated.

"By the former method the engine is equal to 4½ pairs of bullocks and 9 men and by the latter it is equal to 6 pairs of bullocks and 12 men. The cost of running the engine is as follows :—

Cost of running the engine for 7 hours.

Details	Rs.	a.	p.
Starting the engine (½ lb. of Kerosine) ...	0	0	6
Oil consumption in 7 hours (31 lbs.)	1	14	0
Lubricating oil	0	4	0
Engine boy (wages)	0	8	0
*Extra man (wages)	0	8	0
	2	13	6

* Required only on an experimental farm.

"Deducting the wages of the extra man the expense of irrigating an acre of ordinary crop is therefore Rs. 2-10-6, which is higher than the cost as given in my previous report estimated on the working of a larger pump for a short period only, but with a longer working day the cost per acre would be reduced.

"Calculating on the basis of the area irrigated the cost of irrigating an acre by engine and pump is only 6 annas more than the wages of the 12 men required to work the six "kos" that would irrigate at the same rate. The cost of irrigating by engine may be taken as in my

previous report at about half the cost by bullock power. This statement is subject to the condition that the engine is kept in constant work and this pre-supposes a good source of water."

35. *Ensilage.*—A silo was constructed and worked satisfactorily.

36. *Distribution of Seeds.*—Numerous indents were made on the farm by Government stations in other regions for the supply of jowári, bájri, rice, cotton, etc.

37. *Visitors.*—The farm continues to attract much local attention; over 500 persons visited it of whom two-thirds were cultivators. The Superintendent visited villages not only in the Kaira district but also in Ahmedabad and Panch Maháls, and maintained close relations with the members of the Nadiád Agricultural Association.

38. The cost of the farm was Rs. 6,197 and the receipts are reported to be Rs. 3,924. The sale of produce obtained Rs. 1,858 only.

The Dhárwár Station.

Dhárwár.—Established in 1904; *North Latitude* 15° 27′; *East Longitude* 75° 6′; *Height* above sea level 2,580 feet; *Soil* Black clay and laterite; *Average rainfall* 32′ 29″; *Temperature* Maximum 109° in May 1905, Minimum 51° in July 1905.

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall—	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1905-06 ...	0 28	2 19	2 75	1 55	1 19	0 83	3 43	0 24	0 0	0 11	0 0	0 0	12 57
Average ...	1 92	3 59	5 05	6 20	3 54	4 51	5 54	1 15	0 69	Not	availa	ble.	32 29
Temperature (1905-06)—													
Mean maximum ...	95°	95°	37°	77°	81°	82°	81°	85°	81°	82°	85°	89°	
Mean minimum ...	65°	61°	57°	55°	66°	65°	69°	68°	64°	65°	67°	74°	

Area.—74 acres.

Superintendent.—Mr. Malhár Lingo Kulkarni.

40. The Deputy Director describes the *work* of the farm as follows:—

"(1) The improvement of the two local varieties of cotton, *viz.*, Kumpta (indigenous) and saw-ginned Dhárwár (acclimatised American).

(2) The improvement of jowár, wheat, potatoes and other important crops of the district by selection of the local varieties and introduction of others.

(3) The testing of various manures (natural and artificial) and the correctness or otherwise of the local practices in crop rotation and manuring.

(4) Distribution of sound cotton seed selected from cultivators' fields.

(5) Distribution of improved implements.

(6) Experiments on the spice gardens of Sirsi (Kánara)."

41. The *season* was very unfavourable, the rainfall being less than half the average. The greater part of the crops failed and no conclusions of importance can be drawn from the experiments.

42. The *crops grown* on the farm were:—Cotton, jowár, rála, gram, sesamum, wheat, safflower, udid, linseed, potato and groundnut.

The cultivation of Russian linseed for the first time is of interest.

43. The *manures* with which experiments were conducted were:—Ammonium sulphate, bone-meal, farm-yard manure, town-sweepings, muriate of potash, kainite, safflower cake, and as green manures san (Crotolaria juncea) and niger seed.

44. Thirty tons of *cotton seed* were selected and distributed sufficient to sow some four thousand acres. In order to render this measure productive of real benefit however the seed should be obtained by plant to plant selection and skilled agency for such detailed work is not at present available. When whole fields are selected it is impossible to determine whether the character of the produce is due to the superiority of the plant or merely to more favourable conditions of rain or soil or to better cultivation; and there is no guarantee that the seed so obtained will reproduce the superiority of the parent. It is interesting to note that the percentage of lint to seed was found to be in the case of Broach cotton 30 per cent., and of Kumpta 25 per cent.; the reduction of the percentage which has occurred in each case from last year's results is ascribed by Mr. Fletcher to the short rainfall.

45. Arrangements have been made to distribute 1,000 lbs. of Broach cotton seed among cultivators in the current season. This I may note is a repetition of a measure which was first undertaken so long ago as 1844-45.

46. Experiment was made with the introduction of a perennial tree-cotton (Gossypium peruvianum) with little success owing to the unfavourable character of the season and to the want of a well to irrigate the area cultivated. There is, however, some reason to hope for

ultimate success with this cotton on certain soils of the Dhárwár district. The co-operation of a local magnate, the Jáhgirdár of Hebli, in the experiment is commendable.

47. *Cotton-breeding.*—Much attention was paid both to hybridisation and to selection from vigorous plants and in spite of the season some seed was collected from promising crosses and varieties.

48. *Insect Pests.*—Were studied with the help of the Imperial Entomologist and the red cotton bug (Dysdercus cingulatus) was kept in check.

49. *Distribution of Seeds and Implements.*—In addition to the local distribution of 30 tons of cotton seed, seed to the amount of over 5 tons was despatched to the Inspector-General of Agriculture, to various Provincial Departments and numerous private applicants.

The English Turn-wrest plough continues to meet with great favour. Twenty-four of these ploughs were sold to cultivators of Dhárwár, Belgaum and Bijápur. Its chief use lies in eradicating deep-rooted grass weeds for which purpose it is far cheaper than the ordinary practice of digging by hand.

Chaff cutters have also been brought into vogue by the example of the farm, and are now being readily purchased by cultivators from the makers direct.

50. *Visitors.*—Over 100 cultivators visited the farm in the course of the year. Largely owing to the personality of the Superintendent, Mr. M. L. Kulkarni, who has taken up also the post of Secretary to the Dhárwár Agricultural Association, the farm has gained to a surprising extent in the brief course of two years' existence the interest and confidence of the chief landholders of the district.

51. *Kánara Spice Gardens.*—In accordance with the orders of Government issued in Government Resolutions No. 8448, dated 25th November 1899, Revenue Department, and No. 561 of 25th January 1904, Revenue Department, experiments have been instituted to test the manurial requirements of a Kánara spice garden. The problem is of great difficulty and the experiment is on a very small scale. Some indications may however be obtained in the course of a few years, and when a larger trained staff is available the question may be taken up more thoroughly and comprehensively. The cost is reported to be Rs. 87 and the receipts Rs. 29.

52. The total cost of the farm was Rs. 7,526 and the receipts Rs. 769; the sale of the farm crops realising Rs. 417 only against Rs. 1,652 in 1904-05. The failure of the monsoon may be accepted as a sufficient explanation of this heavy deficit.

The Dhulia Station.

Dhulia.—Established 1905; *North Latitude* 21° 10′; *East Longitude* 75° 20′; *Height* above sea level 844 feet; *Soil* medium black; *Average rainfall* 22′ 40″; *Temperature* Maximum 112° in May 1905, Minimum 37° in January 1906.

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall—	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
(1905-06)	0 0	0 0	3 53	9 22	2 71	2 46	0 0	0 0	0 0	0 0	0 0	0 0	17 92
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
Average	0 0	0 0	3 90	5 77	8 97	6 28	0 0	0 0	2 4	8 0	0 0	0 0	22 40
Temperature (1905-06)-													
Mean maximum ...	106°	112°	109°	104°	90°	103°	98°	95°	98°	93°	96°	102°	
Mean minimum ...	50°	75°	70°	69°	67°	65°	53°	47°	39°	37°	38°	45°	

Area.—28⅝ acres.

Superintendent.—Mr. Mohoniráj G. Athalye.

54. The *principal objects* of the station are to

(1) investigate the improvement of the local varieties of cotton and jowár (Andropogon sorghum), and wheat;

(2) investigate problems of well irrigation;

(3) Experiment with manures.

55. The *season* was unusually short, rain falling for three months only from the middle of June to the middle of September.

56. The *crops* cultivated were cotton (varieties Bani, Comilla, Broach and Kumta), jowári, wheat, bájri, sesamum, saidi beans and oats.

57. The following *manures* were tried:—Sulphate of ammonia; mhowra flower refuse. (B assia latifolia); farm-yard manure.

58. *Cotton.*—The comparison of the several varieties grown resulted in the local Varádi being first and Bani second with 698 lbs. and 670 lbs. of seed cotton respectively. It was found that for Varádi the 18" drill is best suited, but for Bani the 24" drill. The shortness of the season proved fatal to the more valuable Broach and Kumta varieties and also to the coarser Comilla. It is remarkable that in spite of the low outturn of Comilla the seed should have been eagerly taken up by the cultivators. The Deputy Director should however consider and report whether this is a suitable variety for distribution before complying with such demands.

59. *Jowári, Bájri, Wheat and Sesamum.*—No conclusions are reported from the experiments.

60. *Cotton-breeding.*—A few crosses were obtained which under irrigation produced fairly good cotton.

61. *Irrigational Experiments.*—Mr. Fletcher found that wheat grown after a fallow required 72,000 cubic feet of water per acre, while wheat grown after a crop of sesamum required 80,000 cubic feet. He observes that this result goes to support the statement that "the effect of fallowing is merely to store up water in the soil for the next season's crop." The superior yield of most unmanured plots was very remarkable. Though the outturn of cotton under sulphate of ammonia was sometimes greater, the excess value did not equal the cost of the manure. Even with irrigated wheat the unmanured plot gave a higher outturn (1,650 lbs) than any other.

Sulphate of ammonia was applied to sugarcane on private fields, and with fair results; the produce being of superior quality. Mr. Fletcher observes that this fertiliser appeared to be a protection against white ants; a very important conclusion which requires careful investigation.

62. *Distribution of Seeds and Implements.*—The farm is so recently established that the needs of the locality are not yet sufficiently known.

63. The *visitor's* list amounted to 342 persons. The Superintendent visited a number of villages in the district, and with more experience will prove a useful officer.

64. The expenditure of the farm was Rs. 3,569 and the receipts Rs. 1,152, the sale of produce realising Rs. 868.

The Mirpurkhás Station.

Mirpurkhás.—Established 1904; *Height* approximately sea level; *Soil* sandy alluvial loam; *North Latitude* 25° 32'; *East Longitude* 69° 2'; *Average rainfall* 5' 91"; *Temperature* Maximum 120° in May 1905, Minimum 40° in January 1906.

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall—	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
(1905-06)	0 0	0 0	0 0	0 39	0 0	0 0	0 3	0 0	0 10	0 0	2 86	0 04	3 39
Average	0 02	0 08	0 61	2 15	2 57	0 14	0 1½	0 10	0 11	0 25	0 23	0 14½	5 91
Temperature (1905-06)-													
Mean maximum ...	90°	100°	98°	98°	91°	92°	88°	85°	74°	67°	71°	83°	
Mean minimum ...	78°	90°	89°	88°	85°	83°	79°	68°	59°	55°	54°	62°	

Note—Rainfall and temperature details are for Hyderbad.

Area.—46 acres.

Superintendent.—Mr. S. B. Máhli, M.R.A.C.

66. The *objects* of the station are to

(1) investigate the soil;

(2) examine methods of irrigation;

(3) introduce superior varieties of cotton;

(4) investigate insect pests;

(5) introduce new varieties of crops.

67. The Deputy Director writes of the experimental work as follows:—

"This station being in the almost rainless Indus Valley—the average rainfall is 5—7 inches—is wholly under irrigation. It receives water from the Jamrao Canal, the only really perennial canal in Sind. Owing to the fact that cultivators on this canal have been accustomed either to the restricted water-supply of inundation canals or to rice cultivation in which it is difficult to apply too much water and in which practically no crop rotation is practised, the land recently put under perennial irrigation from the Jamrao has been exceedingly badly treated and it is a common saying among Zamindárs that much of the land is 'now only fit for rice'. The soil of the Mirpurkhás station has, during the six years it has been under cultivation by cultivators with perennial water, become almost sterile to cotton and the station of which the season under report is the

first has been established for the purpose of discovering and demonstrating the causes and remedies of this sterility. This is a question that cannot from its nature be decided in a season or two, involving, as it does, problems in the chemistry and physics of the soil that can only be solved as the result of continued experiment aided by chemical and physical analysis.

"Even now as the result of the two rabi seasons during which the station has been in existence, it can be stated that even on poor soil of this kind four waterings is the maximum that should be applied to wheat. This result disproves the statement much in vogue that the conditions of climate in Sind demand larger amounts of water than are necessary in other rainless and irrigated countries, *e.g.*, Egypt and California. Of the incorrectness of this statement the excellent yields of wheat obtained in the year under report are witness.

"Measurements of the water requirements of other crops also are in progress. Fodder and manure are very scarce on the Jamrao area and a crop that will undoubtedly supply both these essentials has been discovered in the form of Egyptian clover. Last season's yields have been more than borne out by this season's results, a single cutting in the case of one plot yielding nearly 20,000 lbs. of green fodder. Four or five cuttings should be obtained between September and June if the crop is grown early enough. Another point that has been demonstrated by this farm is that a good native bullock-hoe—an implement unknown hitherto in Sind—will do much to assist cultivators to keep down weeds which on perennially irrigated lands may easily reduce the yield of a crop to vanishing point, and several have been distributed."

68. *Season.*—Except for an attack of cotton boll-worm (*Earias insulana*, Boisd.) which ravaged all cotton both in Sind and the Punjab on an unprecedented scale, the conditions of the season were normal. This pest was investigated in the Punjab by Mr. Maxwell Lefroy, the Imperial Entomologist, who in Occasional Bulletin No. 2 of 1906 (Agricultural Research Institute Series) has published the following information:—

"The most important parasite (*Rhogas Lefroyi, Ashm.*) which generally checks the boll-worm was, I believe, entirely absent from the majority of the cotton districts. It is impossible to account for this extraordinary feature with any positive degree of certainty. The only abnormal circumstance that I can find is the extreme cold of the preceding winter, a cold which may have destroyed Rhogas while leaving the boll-worm. This is a bare hypothesis, but one which is borne out by our knowledge of the effect of climatic changes on insect life. If we seek to account for the abnormal outbreak of boll-worm, we may say that the abnormal cold almost wholly destroyed the principal check on the boll-worm so enabling the pest to increase in a manner approximating to its maximum."

69. *Crops.*—The principal crops cultivated on the station were, Egyptian, American and Sindhi cottons, wheat, Egyptian clover, maize, sugarcane, jowár and groundnut.

70. *Egyptian Cotton.*—The varieties selected are Abassi (commercially know as White Egyptian) and Metafifi (Brown Egyptian). The value of these varieties compared with "Middling American" and Sindhi was as follows:—

On January 5th 1906—

Abassi 9*d.* per lb.

Metafifi 8½*d.* per lb.

"Middling American" 6¼*d.* per lb.

Sindhi 4½*d.* per lb.

Some twenty acres were cultivated, the Egyptian cotton being sown in March and April and the Sindhi in May and June. The average outturn was 240 lbs. of seed cotton per acre for Egyptian and 295 lbs. per acre for Sindhi. Both these yields are exceptionally poor. Mr. Fletcher ascribes them in part to the ravages of the boll-worm, in part to the poor quality of the soil of the farm, and to certain difficulties experienced in the application of irrigation—difficulties which have now been overcome.

71. The average yield of Egyptian cotton on 1,500 acres cultivated by landholders was approximately 400 lbs. of seed cotton. Sindhi cotton is harvested by November, while the Egyptian is then in full bearing, and continues into late January. The season for Egyptian cotton was prolonged by unusual hot winds and before it could all be brought in a sharp frost occurred and destroyed the later pickings. The proportion of lint to seed varies considerably from 26 per cent. for Abassi to 32 per cent. for Metafifi and 33 per cent. for Sindhi.

72. *Wheat* is sown early in November, flowers in February and ripens in middle April. The outturn was very uneven varying from 570 lbs. to 1,920 lbs. of grain per acre. Mr. Fletcher considers the results to indicate that three or four waterings of some 5,000 cubic feet each are sufficient, and that Sindhi white wheat, if selected, should prove to be as valuable as any imported varieties.

73. *Egyptian Clover* (Berseem).—This crop has been introduced by Mr. Fletcher on account of its value (*a*) in improving the soil by rotation and adding supplies of nitrogen, and (*b*) as supplying a fodder of which there is great scarcity in this region. The varieties selected are Miscawi, Saidi and Fahali. The best time for sowing is believed to be September.

The best result obtained was one cutting of 20,000 lbs. green fodder and 1,500 lbs. of hay. Most of the plots were however grown for seed.

74. *Maize.*—The outturn was very poor less than 800 lbs. grain per acre.

75. *Sugarcane* failed owing to the poverty of the soil and the attacks of white ants.

76. *Jowár.*—An imported Gujarát variety (Chapti) produced 1,017 lbs. grain per acre, and in spite of this small yield was in demand with local land-holders for seed.

77. *Groundnut.*—Six varieties were tried and yielded from 360 lbs. to 1,200 lbs. per acre.

78. *Russian Linseed.*—Gave good promise.

79. *Sesamum and Gram.*—Succumbed to insect pests, which are under investigation.

80. *Cross-breeding and Irrigational Experiments.*—A commencement has been made with experiments in breeding cotton and wheat and with investigations into the water requirements of crops, but owing to the want of a trained subordinate staff the progress made has been slight.

81. *Staff.*—In order to provide this staff, Government sanctioned the entertainment of four probationers to be trained on the farm. Difficulties occurred however and three men resigned in the course of the year. Owing however to the awakening of interest in agriculture in Sind, and to the prospects of employment in a new department a considerable number of students have joined the agricultural course in Poona, and in a few years will be available for the development of the work in Sind. Meantime it is necessary that the Deputy Director of Agriculture should utilise the services of selected officers of the Revenue Department. For even though they have no technical knowledge of agriculture men can be found who belong to the land-holding classes and who are capable of carrying out instructions with fidelity and intelligence.

82. *Distribution of Seed.*—Some 31,000 lbs. of Egyptian cotton seed were distributed early in 1905 from which last year's crop was grown. This was chiefly of the Metafifi variety, and, since the Deputy Director recommended that the Abassi variety was best suited to Sind, arrangements were made with the Karáchi firm, which succeeded in buying almost the whole crop from the cultivators, to export all the seed of the 1905-06 crop. For the current year therefore it was necessary to import fresh seed and fifty tons of Abassi were obtained and distributed sufficient to sow 6,000 or 7,000 acres. Nine-tenths of the seed was sown in the tract which runs due south of Mirpurkhás for 60 miles.

83. The question of the variety which will ultimately be found to suit the conditions of Sindi agriculture best cannot be regarded as definitely settled on the experience of a couple of years. The price of Abassi is ordinarily higher than of Metafifi; but in the trial consignments despatched by the Department for sale in Liverpool by the British Cotton Growing Association Abassi realised 8½ d. per lb. against 9 d. per lb. for Metafifi. The proportion of lint obtained from the seed cotton in Metafifi is 33 per cent. greater than in Abassi; and in Egypt experience has shown that Metafifi is a more hardy variety.

It is necessary therefore to suspend judgment and continue to test the several varieties of Egyptian cotton on the Mirpurkhás station.

84. *Groundnut.*—A ton of seed was distributed for experiment to District officers, but failed in every case but one owing, the Deputy Director considers, to unsuitable conditions of cultivation. The Vazir of Khairpur however reports favourably upon it, and has obtained four tons of seed for cultivation in the current year. The experiment merits perseverance.

85. *Egyptian Clover.*—Some 5,000 lbs. were distributed in Sind, but the results are not reported.

86. *Distribution of Implements.*—The agriculture of Sind is notoriously backward, chiefly owing to the sparsity of population and the easy conditions of existence for the labouring classes. Mr. Fletcher notes the prevalence of weeds in cultivation and the need for implements of inter-culture. However though such implements may be imported it is improbable that they will be utilised until the necessity of a superior style of cultivation forces itself upon the people. Good can no doubt be effected by the introduction of superior implements from other parts of India, but before the standard of cultivation can be raised appreciably, the cultivators must first learn their use and must train the oxen. It is a far cry from the nomad state of life, from which the Sindhi peasant is just emerging to the intensive farming of the Kaira Pátidár.

87. *Alkali.*—Apprehensions have been expressed that the growth of alkali or saline efflorescence in the soils of Sind may materially injure the irrigational future of that province. This view is not however adopted by the Irrigational officers who maintain that experience in the Punjab proves that the canals have greatly diminished alkali; and in any case it will probably be always possible to grow rice—a very remunerative crop highly popular with the cultivator. The matter is however of sufficient importance to demand special investigation, and proposals to this end have been placed before Government.

It is possible that application of gypsum may prove of assistance in the reduction of alkali. For the most part throughout India, the sources of gypsum are so far distant from the saline tracts that the cost of freight renders its application impossible. The authorities of the Bikáner Railway have however supplied gypsum to Mirpurkhás from a station 170 miles distant at a rate of less than 4 rupees per ton and hold forth prospects of opening up a trade therein.

88. The farm was visited by 100 persons, half of whom were land-holders.

89. The gross cost of the farm was Rs. 11,387, the profit and loss statement shows receipts of Rs. 2,923 the sale of farm produce producing Rs. 1,062.

The Poona Station.

Poona.—Established in 1879; *North Latitude* 18° 30′; *East Longitude* 73° 50′; *Height* above sea level 1,850 feet; *Soil* 3/4ths medium black and 1/4th light murum; *Average rainfall* 30 inches; *Temperature* Maximum 108° in April 1905, Minimum 40° in January 1906.

	April.	May.	June.	July.	August.	September.	October	November.	December.	January.	February.	March.	Total.
Rainfall—		′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″				′ ″
(1905-06) ..	...	2 46	2 12	9 96	1 55	0 21	4 27	0 40	...	...	...	...	20 97
Average ...	...	0 94	4 67	9 90	4 55	4 33	3 97	0 38	0 32	...	...	...	29 06
Temperature(1905-06)—													
Mean maximum ...	89°	92°	88°	81°	79°	80°	85°	78°	73°	79°	78°	83°	...
Mean minimum ...	69°	84°	77°	72°	72°	73°	73°	66°	60°	61°	62°	71°	...

Area.—35 acres.

Superintendent.—Mr. V. K. Kogekar.

91. The *season* was somewhat unfavourable, the rainfall being 8 inches below the average. But the crops were saved by occasional irrigation from the Mutha Left Bank Canal.

92. The chief *purpose* of the farm is to demonstrate the cultivation of crops to the students of the agricultural course in the College of Science. It is also used for the botanical classification of crops by Professor Gammie and in part for the growth of fodder for the dairy.

93. An *agricultural museum* is in course of preparation, containing collections of soils, manures, seeds, fibres, botanical specimens of all kinds, and indigenous and imported implements.

94. *Entomological and Mycological Work.*—The chief pests were aphides and in jowári the sugar borer. They were checked to some extent, in the case of aphides by Kerosine emulsion and in the case of the borer by removal by hand.

95. *Experiments* were continued in *steeping* groundnut seed in one per cent. solution of copper sulphate and in spraying the crop with Bordeaux mixure, the plot selected having been affected with Tika disease for several years.

It is difficult to draw any definite conclusions from these experiments since the results of the several varieties and of the several methods of treatment are most contradictory, and in no case has an average outturn been obtained.

96. *Wilt Disease of Tur.*—The seed was sown in a diseased field and out of 16 varieties only 9 were found to resist the disease, to a greater or less extent. Seed has been selected and it is hoped that eventually a variety may be found which will be proof against this disease.

97. *Rust.*—Attempts have been made to find a wheat which will resist rust and seed was selected from several varieties which were the least affected.

98. *Botanical Experiments.*—A classification was made of 53 varieties of cucurbits, 80 varieties of jowár and 266 varieties of rice and several perennial cotton trees.

99. *Forage Crops.*—Guinea grass, maize, and pulses were grown.

100. *Demonstration.*—Object lessons plots included numerous varieties of cereals, pulses oil-seeds, fibre plants, several varieties of chillies, vegetables and sugarcane belonging both to the kharif and the rabi seasons.

The students cultivated a portion of the farm with their own hands.

101. *Distribution of Seed and Implements.*—Arlington Turn-wrest ploughs, country drills and harrows were supplied to the number of 47 to 36 applicants from all parts of the Deccan.

Seed was also supplied of tobacco, cotton and chillies.

102. *Visitors.*—Seventeen persons are reported to have visited the farm, but since it lies between two public roads it is visited by numerous persons who are not registered at the office.

103. The total expenditure of the year amounted to Rs. 6,303 and the produce sold from the farm amounted to Rs. 1,015.

The Poona Dairy.

Poona Dairy.—Established in 1890.

Area of Fodder Farm.—46 acres.

105. The principal *objects* of the dairy are—

(1) to serve as a model dairy;

(2) to instruct agricultural students in the management of the dairy and the feeding of dairy cattle;

(3) to improve breeds of dairy cattle; and

(4) to supply the use of good bulls of milk breed.

106. The year was unfavourable owing to the great scarcity of dry fodder and to the difficulty of maintaining a constant supply of green fodder.

107. Cattle suffered from an outbreak of liver flukes and of diarrhœa and an attack of foot and mouth disease, which were checked by timely precautions. To guard against the latter danger direct communications are now secured from the farm to the river so that the cattle need not cross the public roads from which they were believed in the past to have received the infection.

108. The cattle consist of the following breeds :—

Cows.—Aden, Sindhi and Gir.

Buffaloes.—Surti, Delhi and Jaffrabadi.

The total number of cows and of buffaloes was 96. The average yearly yield per cow was 2,038 lbs. and per buffalo 2,484 lbs., the average daily yield being 540 lbs. cows' and 442 lbs. buffalo milk or a total of 992 lbs.

109. The net loss for the year is reported to be Rs. 3,895 as against Rs. 1,150 last year and the profit of over Rs. 6,000 in the preceding year. From the notes appended to the 2 milk statements it will be seen that these statements are mainly intended as a guide for breeding purposes and it is in this direction that most progress has been made. It is satisfactory to note that the Gir cows are beginning to establish a reputation as reliable milch cattle and the increase of farm-bred heifers which have come into milk is very satisfactory. The dairy and farm attached are necessarily worked to some extent on experimental lines and economy must at times be sacrificed in the interests of investigation and instruction.

110. *The fodder feeding experiments* reported are not very conclusive, but the test of peas and oats as a fodder has advanced a stage further. Ridge cultivation for an irrigated crop has once more justified itself in the case of lucerne.

The Mánjri Station.

Mánjri.— Established in 1894; *North Latitude* 18° 30′; *East Longitude* 73° 59′; *Height* above sea level, 1,850 feet; *Soil* medium black and light murum; *Average rainfall* 27 inches.

	April.	May	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall (1905-06)	0′ 0″	4′ 43″	0′ 76″	5′ 37″	1′ 73″	0′ 63″	1′ 95″	0′ 43″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	15′ 21″
Average			Figur	es not	availa	ble; a	pproxi	mately	3′ less	than a	t Poona.		

Note.—Temperature details as for Poona.

Area.—62 acres.

Superintendent.—Mr. Hari Krishna Dándekar.

112. The *season* was unfavourable. The rainfall amounted to 15¼ inches, of which one third fell before the commencement of the cultivating season, which was further broken by almost a complete drought of two months. The farm is, however, commanded by irrigation from the Mutha Right Bank Canal, and the experiments were not materially affected by the failure of the rains.

113. The farm was furnished with a complete set of new buildings at a cost of Rs. 26,600 and the area was extended by the purchase of 17 acres at a cost of Rs. 9,267.

114. The *purpose* of the farm is to investigate the most efficient method of cultivation under irrigation. And to this end the following experiments are constantly in progress :—

(1) the investigation of the best method of manuring sugarcane;

(2) investigation of crops for rotation with sugarcane;

(3) the introduction of superior varieties of sugarcane; and

(4) the distribution of seeds.

115. The principal *crops* under experiment were: sugarcane, cotton (Broach and Kumta varieties), groundnut, jowár, sweet potato, maize, túr and san (*Crotalaria juncea*).

Small plots were also grown for seed of flax, rice, barley, oats, gram, wheat, various pulses and minor millets. The manurial experiments included poudrette, farm yard manure, safflower, oil-cake and mineral manures.

116. *The Application of Potash to Sugarcane.*—The first experiments with sugarcane at Mánjri led Messrs. Mollison and Leather to the opinion that the soils of the Deccan possessed a sufficient natural supply of potash and did not require artificial additions. Mr. Knight's recent experiments tend towards the contrary inference but are not yet conclusive. The potash was applied in the form of sulphate of potash in quantities varying up to 200 lbs. per acre, and was purchased from a Bombay firm at a cost of Rs. 16 per maund of potash or Rs. 8 per maund of the compound fertilizer.

117. *Phosphoric Acid Requirements for Sugarcane.*—The necessity of the addition of this element is still in doubt; it was supplied in the form of superphosphate in quantities varying up to 200 lbs. per acre and was purchased from a Bombay firm at a cost of Rs. 18 per maund of phosphoric acid or Rs. 6 per maund of superphosphate.

118. *Top Dressing of Sugarcane.*—The opinion recorded by Mr. Knight last year that sugar required in the early stages of its growth a fertilizer which is rapid in its action, such as safflower cake, was corroborated by further experience. The results of the experiments with oil-cakes were less favourable to safflower cake than usual owing to the abnormal increase in its price. Oil-seeds have fared very badly in both this season and 1904-1905, and the price has increased since the beginning of 1905 from the rate of Rs. 1-9-0 per maund to Rs. 2-10-0. Nevertheless, it remains the cheapest fertilizer available on this side of India if calculated on the basis of the units of nitrogen contained therein, the price per pound of nitrogen being now approximately 5 annas.

119. *Mineral Manures.*—A plot which received a complete manure in the shape of 100 lbs. potash, 100 lbs. phosphoric acid and 350 lbs. nitrogen at a cost of Rs. 342 per acre gave an outturn of over 13,000 lbs. of gul. The value of gul amounted to Rs. 870, and, deducting the cost of cultivation, the net profit was Rs. 335.

120. *The Nitre experiments* with rice were inconclusive.

121. *Irrigation Experiments.*—In one case 245,000 cubic feet of water were applied in 27 waterings of 2½ inches at intervals of 10 days. In the other case 325,000 cubic feet were applied in 20 waterings of 4½ inches at intervals of 15 days, and the net profit of the first plot was 50 per cent. greater than of the second. In considering this it is to remembered that the rainfall of the season amounted to 15 inches in addition.

122. *Irrigated wheat* gave an outturn varying from 1,400 lbs. per acre to 2,600, the best plot receiving 2 inches of rainfall every 10 days.

123. *Methods of Cultivation.*—Mr. Knight advocates the planting of maize and jowár sufficiently wide to enable interculture with bullock hoes, and the plantation of cotton at greater distances than the space of two feet which is customary here. This suggestion depends somewhat on the germinating power of the seed in irrigated cultivation. Thick and close sowing is practised here as a safeguard against failures of germination due to want of rain and the inferior quality of seed. Even under irrigation we have seen plots on the farm suffer from the latter cause. These suggestions, therefore, seem to me to require further consideration.

124. *Rotation Experiments.*—Irrigated cotton (Broach) was grown with good success, but the results reported do not give it full credit; firstly since the outturn was diminished by an entomological experiment tried, and secondly because the produce was not sent to be valued as Broach cotton but was sold in the bazár at the ordinary Deccan rate. These points deserve more attention from the management of the farm.

125. On the light soil of the farm experiments were made in the cultivation of pulses and cereals. Ordinarily such soil would not receive irrigation, but when the block system is introduced on the Deccan canals cultivators may be able to spare water for the occasional watering of such areas and the results obtained on the farm will be of assistance to them. Barley gave good outturns upto a gross value of Rs. 69 per acre on a basis of 24 lbs. per rupee. The amount of irrigation applied should have been reported.

126. *Linseed.*—M. De Klemm, Russian Consul General, kindly supplied us with seed from Central Asia which has been tried on various farms. The first trials were not successful, but seed has been preserved for further experiments.

127. *Sugar Borer.*—Experiments to check this pest are of the greatest importance. They are most injurious in the earliest stages of the growth of the plant and the opinion recorded by Mr. Knight that attacks are most frequent in May, if corroborated by wider experience, shows

the importance of early planting. Possibly this fact is one of the grounds for the ordinary practice already obtaining of plantation in January and February.

128. Of the various *new crops* of which trial was made American field beans were found to grow well on poor soil and to give a larger outturn than any indigenous leguminous crop. Mr. Knight is attempting to introduce it into local use.

129. *Selection and distribution of seed.*—Sugarcane, maize, jowár and groundnut were distributed to cultivators. One hundred and fifty-five requisitions were received and were complied with. In addition Government stations were supplied with seed of bájri, rice, túr, soybeans, suran, and sweet potato.

An important experiment was made in the despatch of sugarcane sets to Umarkot whence the Deputy Commissioner has consented to supply sets to other parts of Sind where the variety of sugarcane grown is very inferior.

130. *Visitors*.—Four hundred and fifty-eight persons visited the farm, mostly cultivators from Sátára and Sholápur. The management of the farm has passed through several hands in the last two years and the new Superintendent should establish relations with villagers along the Mutha Canal.

131. The total cost of the farm was Rs. 10,070 and the receipts amounted to Rs. 11,473.

The Lanowli Station.

Lanowli.—Established in 1904; *North Latitude* 18° 45′; *East Longitude* 73° 27′; *Height above sea level* 2,039 feet; *Soil* light; *Average rainfall*—186 inches.

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall—	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″		′ ″
1905-1906	0 0	0 11	6 70	60 69	28 16	8 61	1 53	0 87	0 0	0 0	0 11	...	106 78
Average	0 43	0 87	29 3	71 81	56 46	23 66	3 9	0 84	0 25	0 5	0 8	...	186 56

The *rice experiments* at Lanówli were continued.

133. There were 106 inches of rain received, of which 88 inches fell in the months of July and August, and the *season* was unfavourable owing to the deficiency of later rain.

Where the rainfall is so heavy it is a matter of great difficulty to conduct manurial experiments so as to prevent the effect of the manures on adjacent plots being conveyed to one another and thus vitiating the results. Further, owing to the hilly character of the ground the cultivation takes place in terraced beds from which there is a constant overflow and subsoil drainage from one terrace to another. These difficulties can only be overcome by experience and careful management, and I apprehend that it will take several years to arrive at any definite results.

134. In the present season, in regard to the field crops Mr. Knight reports that "after transplantation heavy and continuous rain flooded the crops and kept the seedlings drowned for several days and caused the plants to rot. The seedlings remained unhealthy and never recovered. All the manures were washed away and had no effect on the crop."

In regard, however, to the seed-beds some interesting results were obtained as to the comparative value of different methods of cultivation.

The following is the order of the most successful methods, judged by their gross outturns :—

1. Cowdung ploughed in.
2. Cowdung ráb.
3. Ashes of cowdung.
4. Fish.
5. Ashes of ain ráb (*Terminalia tomentosa*).
6. Safflower cake.

135. *Varieties of rice.*—The varieties of rice grown in this Presidency are very numerous, but little information as yet is possessed regarding their characteristics. Fifty-three varieties were sown for purposes of observation.

136. *Application of nitre.*—This experiment was made in plots placed at our disposal by cultivators in Thána and Kolába. Owing to the unfavourable and deficient rainfall the outturn was below normal, and though in many cases it was somewhat superior to the outturn of unmanured crops the experiment cannot be said to have been successful.

The Ganeshkhind Botanical Station.

Re-established in 1904; *Soil* reddish alluvial loam of great depth; *Position, Temperature, Rainfall* same as in Poona.

Area—80 acres.

Curator—Mr. G. B. Patwardhan.

138. This garden was first established in 1873 and maintained for some ten years. Plants and experiments were then transferred to what is now the Empress Gardens in Poona and the Ganeshkhind Garden was allowed to relapse into jungle. It is now being restored by Mr. Gammie.

139. The monsoon rain was badly distributed, but occasional waterings were applied from the Mutha Left Bank Canal and from wells.

140. The principal plants under cultivation were :—

(1) rubbers including *Cryptostegia grandiflora, Castilloa elastica, Hevea brasiliensis* and *Kicksia africana ;* and

(2) fibres, agaves, ramie and cottons, and of the last named 450 varieties including annuals, perennials and American varieties and crosses were grown.

Mr. Gammie reports that Egyptian and the Upland Georgian varieties grew well without irrigation. Hitherto Egyptian cotton has refused to grow on the Poona and the Mánjri farms.

141. Observation of the *tree cottons* leads to the conclusion that they require shelter from strong winds, and in exposed places are apt to die.

142. *Flower-selection trials.*—Mr. Gammie expressed the opinion that the deterioration of annual garden plants in India is mainly due to want of care in selecting plants for seed.

143. *Grass experiments.*—The substitution of valuable edible grasses for the rank growth which mostly encumbers forest areas is a question of great importance. Experiments were made to eradicate the useless grasses growing in the garden, such as *Aphirerus corymbosus* and *Andropogon contortus,* and substitute Italian rye grass, perennial rye grass, *Dactylis glomerata, Festuca elatior, Phleum pratense* and an indigenous *Andropogon.* The result will not be ascertained for certain for several years.

144. *Vegetable garden.*—Attempts are being made to introduce superior varieties of vegetables amongst the gardens surrounding Poona. Most of the species grown were very successful.

145. *Jute cultivation.*—Two plots have been cultivated with jute (*Corcoras capsularis*), of which one is in poor condition and one at the time of writing gives good promise.

146. An *Herbarium* collection is in course of preparation and has made good progress.

147. The expenditure of the garden amounted to Rs. 4,227.

The Bassein Botanical Station.

Bassein.—Established in 1906; *North Latitude* 19° 20′; *East Longitude* 72° 51′; *Height* approximately sea level; *Soil* sandy alluvial loam; *Average rainfall*—83 inches; *Temperature*—maximum 92° in November 1905; minimum 56° in January 1906.

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Rainfall—													
1905-1906	...	...	4 25	14 75	6 97	5 93	1 36	0 08	...	...	0 18	...	33 52
Average	0 02	0 26	18 75	30 30	18 56	13 81	1 57	0 09	0 05	0 10	0 02	...	83 53
Temperature (1905-06)—													
Mean maximum ...	83°	88°	89°	84°	86°	85°	83°	87°	84°	82°	80°	83°	
Mean minimum ...	73°	80°	80°	80°	80°	78°	75°	73°	66°	63°	65°	70°	

Area—90 acres.

Curator—Mr. H. P. Paránjpe.

149. Possession was taken from the 3rd February 1906 and the early operations consisted chiefly of the clearance of jungle. Arrangements have been made with the Superintendent of the Archæological Survey for the preservation of the principal buildings of archæological interest.

150. Experiments have been commenced with 4 varieties of rubber, 8 varieties of cotton, both tree cotton and Egyptian varieties, jute, cassava, beans, millets, plantains, betel, pepper, lemon grass and pine apples.

151. Various plants have also been collected for the extraction of gum, and Mr. Gammie reports that large numbers of the ordinary botanical garden trees, shrubs and herbs are being rapidly grouped together. An interesting plan of the fort and its buildings is attached to this report.

APPENDIX B. (*Vide* para. 24.)

Extract from the letter No. C.-44, dated 19th May 1906, from the Director of Agriculture to the Secretary to Government, Revenue Department, Bombay.

* * * * *

5. Various attempts have been made in the past to grow Egyptian cotton in Sind, but have ended in failure. These attempts were revived by Mr. M. D. Mackenzie, Deputy Commissioner, Thar and Párkar, who succeeded in growing a good crop in December 1903. Shortly after his arrival in this country Mr. Fletcher, the Deputy Director of Agriculture, was sent to Sind to report on Mr. Mackenzie's experiments. On Mr. Fletcher's recommendation a Government experimental farm was established and in the winter of 1904 Mr. Fletcher secured a very good crop of Egyptian cotton on an area of some 14 acres. To Mr. Fletcher is due the credit of pointing out that the proper season for this crop in Sind is from March to November. This fact restricts the cultivation to the small areas served by perennial canals, for no inundation canals are able to supply water before May.

6. The success of the crop in 1904 was so remarkable that although we were advised by the Board of Agriculture that the cultivation must be regarded as purely experimental and could not be recommended with confidence to the cultivators on the strength of the experience of a single year, we decided to import 10 tons of Egyptian seed and distribute it amongst the cultivators. With this imported seed and the seed obtained from the previous year's cultivation 1,500 acres in all were cultivated.

7. The disposal of the produce of 1905 has been the subject of anxious consideration. It was anticipated that the local Banias or middlemen would refuse to deal with it owing to their want of knowledge of the value of the staple, and this anticipation was fully confirmed. At the same time it was considered inadvisable that Government should enter into competition with private trade in direct purchases. There are several large firms in Karáchi which deal in cotton and the matter was brought to their notice. They were, however, reluctant to make the special arrangements necessary for the disposal of so small a crop scattered over a large area with considerable difficulties in the way of inspection and carriage. Intimation was also given to the mill-owners at Ahmedabad (where several mills used Egyptian cotton) and samples were shown to several of the chief mill-owners in Bombay City, but only one or two men sent representatives to Sind, and, so far as I am aware, their purchases did not exceed 60 bales.

8. Our chief reliance was placed on one firm in Karáchi with the head of which Mr. Sly, the Inspector-General of Agriculture, and I had an interview on November 2nd, 1905. This firm has a large number of local agents in the cotton tract than any other, and they undertook to purchase all the cotton available at the full value, reserving to themselves only the ordinary commercial profit. I requested the Colonization Officer to give their representatives and all other purchasers every assistance in ascertaining where the cotton was obtainable.

9. In a recent letter the firm informs me that they succeeded in obtaining 283 maunds of Abassi seed cotton and 5,400 maunds of Metafifi seed cotton, and that the outturn of lint was respectively Abassi 26·2 per cent. and Metafifi 32·3 per cent., and they offer the following observations :—

> "It is noticeable that the outturns of the Metafifi correspond almost exactly to those of the indigenous Sind cotton. Those of the Abassi are considerably lower, but as you doubtless know the best staple varieties in India often give such a poor outturn as compared to the usual run of staple that the better price of the lint is not sufficient compensation for the smaller quantity obtained.
>
> "We might here say that we would have been able to increase the price paid, were it not for the fact that we had to keep setting some gins constantly to gin the Egyptian cotton, which was delivered to us only very little at a time, and then resetting them for the usual cotton till we got more Egyptian phooties, as the gearing has to be changed to suit this variety."

10. From the reports of local officers I learn that the payments made to the cultivators by the several purchasers who entered the market amounted on an average to about 5½*d.* per lb. of lint for Metafifi and 7½*d.* per lb. of Abassi. On the basis of the sales recently reported from Liverpool of 9*d.* per lb. for Metafifi and 10*d.* per lb. for Abassi it would appear that the cultivators obtained about 60 per cent. of the value of the cotton delivered in Liverpool. With the greater competition that will be forthcoming in the present season the cultivators will secure a larger percentage. But it must be recognised that the expense and trouble of organising the collection of this cotton and of making special arrangements to gin it are at present considerable, and the cost of carriage to Karáchi, freight to England and sale there have to be deducted. Since there is no expert available in India who is capable of forming a reliable estimate of the value of this staple, it is natural that purchasers should allow a wide margin to cover the risks of an erroneous valuation.

11. The total outturn has proved a disappointment. In January Mr. Fletcher announced to the Board of Agriculture that the outturn probably averaged a bale or a bale and a quarter per acre. This would be equivalent to 1,200 to 1,500 lbs. of seed cotton per acre, or a total outturn of 1,500 to 1,800 bales. In order not to be oversanguine in speaking to the Agricultural Conference in Bombay I reduced this estimate to 1,000 bales. In March and April Mr. Fletcher forwarded to me two other estimates, the first of 550 lbs. of seed cotton per acre and the second of 1,000 lbs. Mr. Chatfield, the Colonization Officer, informs me that the variation between different fields was enormous, ranging from 240 to 2,000 lbs. per acre.

12. The figures of sales within our knowledge are as follows :—

	Bales.
Two Karáchi firms	400
Ahmadabad mills (about)	25
Agricultural Department	15*
	440

* Correct figures are not yet reported.

Casual purchasers may have secured another 60 bales, bringing the total up to 500 bales. This on an area of 1,500 acres would represent 400 lbs. of seed cotton per acre, and on the prices above reported the cultivator would, therefore, have received about Rs. 45 per acre.

13. This sum is considerably below the expectations which the cultivators held of the profits of Egyptian cotton, as an unauthorised announcement was made to them that the crop would be purchased at double the price of Sindhi cotton. When the Punjab crop failed the price of Sindhi cotton rose from Rs. 5 per maund to Rs. 7, and though the prices received were 75 per cent. to 100 per cent. in excess of the normal Sindhi price, the minds of the cultivators were somewhat disturbed by the unfulfilled announcement. However, in spite of the low yield and of grumblings regarding the price, the Colonization Officer has secured the cultivation of 6,000 acres in the current season.

14. The question arises whether on this basis of receipts a large extension of Egyptian cotton cultivation is likely to take place. I have expressed my belief elsewere that 100,000 bales may be anticipated in the course of a few years, and I am inclined to adhere to that belief. The year has been very unfavourable to all cotton in North-Western India. The Sindhi and the Punjab crops were barely half the average. Mr. Fletcher has reported that the outturn of Egyptian cotton this year is less than half of what may be expected in a normal year, and Mr. Chatfield states that the season was prolonged by hot winds until the frost suddenly came after Christmas and destroyed the crop before it had time to ripen thoroughly. Further, the boll-worm (from which in November the Egyptian cotton was understood to be free) injured it seriously as the season developed.

15. The calculations on which my estimate of 100,000 bales is based are as follows :—

There are in Sind two chief perennial canals, the Jámráo and the Fuleli. The total area cultivated on each canal was, respectively, Jámráo 270,000 acres and Fuleli 350,000 acres. Cotton cultivation is becoming more popular and better known and in the last five years has increased on these canals from 23,000 acres to 90,000 acres on the Jámráo and from 11,000 acres to 22,000 acres on the Fuleli.

Owing to various economic causes, such as the scarcity of labour, the laziness of the cultivator, who has no desire to earn more than his living, and is able to earn his living with much less labour by growing food-grains, the extension of the cotton area may be slow. But there appears to be no reason why one-third of the whole of the annual cultivation of 600,000 acres on these two canals should not be put under cotton in rotation every year. If Mr. Fletcher's estimate of one bale per acre, which is approximately the Egyptian standard, is accepted, this would give an outturn of 200,000 bales and the estimate which I have ventured to publish of 100,000 bales will be doubled. But I do not think that Sind will attain to the Egyptian standard for many years until the pressure of population has led to a great improvement in methods of cultivation.

16. Perhaps some figures to show the relation of this outturn to the supply of cotton and in particular of Egyptian cotton may be of interest to Government.

The total supply of the chief cotton-producing countries is placed by some authorities at about 60 million cwt., of which in very round figures

45 millions belong to America.
10 do. do. India.
5 do. do. Egypt.

(I omit all minor sources of supply.)

Of the total supply, approximately one-third is utilised in America, one-third on the Continent and one-third by England and India, in the proportion of England two-ninths and India one-ninth. Of the Egyptian supply rather more than one-half is taken by England. The situation, therefore, will not be seriously affected by the substitution of 100,000 bales or 350,000 cwt. of cotton of Egyptian staple for cotton of a low grade Indian staple.

17. On the other hand the importance to the Sindhi cultivator is very great. 100,000 bales will bring to the Province a sum varying from £1,000,000 to £1,500,000 according as the price per lb. fluctuates from 6*d.* to 9½*d.*, while the whole land revenue of Sind is less than £700,000.

18. In a general survey of the future possibilities of Sind it is necessary to include a reference to the projected dam on the Indus above Sukkur. If this is built, new perennial canals will take the place of the present inundation canals and the area over which Egyptian cotton may be cultivated may be increased five-fold, but the fulfilment of this project is so uncertain that speculation as to its possible results is premature.

19. The question of the immediate expansion of cotton cultivation in the current year was discussed by the Inspector-General of Agriculture, the Deputy Director of Agriculture, the Colonization Officer and myself in Sind last October, and it was decided that it was advisable to restrict the cultivation to such area as could be effectively supervised in order to introduce a knowledge of the Egyptian methods of cultivation which the Deputy Director considers essential to its success. 50 tons of seed were imported from Egypt and 6,000 acres of cotton are reported to have been sown. If the season should prove as unfavourable as the last, some 2,000 bales of cotton may be secured, but with a normal season the outturn may amount to from 4 to 6 thousands bales.

20. This fact is now well known to all persons interested in cotton in Bombay, Karáchi and Ahmadabad, and it is to be hoped that their mutual competition will enable the cultivators to secure considerably higher prices this year. In my opinion the most effectual means of achieving this end would be the co-operation of the land-holders in forwarding their consignment for sale to Bombay. I am in correspondence with the Commissioner in Sind and the Colonization Officer regarding the organization of such co-operation, and Mr. Chatfield, the Colonization Officer, has expressed his confidence that he will be able to carry out this measure.

* * * * *

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APPENDIX C.

(REFERRED TO IN PARAGRAPH 13 OF THE REPORT.)

Statement of Expenditure on Agricultural Department.

	Imperial Grant.		Provincial Grant.	
	Revised 1905-06.	Budget 1906-07.	Revised 1905-06.	Budget 1906-07.
Superintendence.	Rs.	Rs.	Rs.	Rs.
Director of Agriculture	10,000	28,000	...	13,970
Deputy Director of Agriculture ...	...	...	16,918	19,218
Superintendent of Farms	...	4,000	2,000	2,900
Inspector of Farms	...	...	...	2,700
Divisional Inspector in Sind	...	...	...	2,996
Total ...	10,000	32,000	18,918	41,784
Education.				
Salary of Agricultural Chemist ...	...	...	3,000	8,761
Professor of Botany	...	...	2,400	...
Pay of two Clerks	...	...	120	...
Salary of ten Assistants	...	...	2,700	...
Travelling Allowance for Professors ...	...	...	1,500	...
Do. of Assistants, Clerks, Contingencies ...	...	...	1,000	...
Working Grant for Ganeshkhind Garden ...	...	...	5,000	...
Employment of one Assistant Superintendent for the Poona Farm, Agricultural Probationers, and one Laboratory Assistant under the Professor of Agriculture at the College of Science	...	...	3,510	...
Purchase of Land for Seed Farm at Surat ..	...	...	3,000	...
Mr. Dixon's Pay and Travelling Allowance .	...	...	650	...
Temporary Quarters for the work of Agricultural Chemist	...	...	4,670	...
Professor of Agriculture	...	...	600	10,948
Assistant Professors	...	...	...	4,800
Native Assistants	...	...	...	6,700
Economic Botanist	...	...	5,000	12,786
Total ...	...	...	33,150	43,995
Farms.				
Poona	...	...	9,020	8,544
Mánjri	...	...	10,307	10,842
Nadiad	...	...	6,690	9,222
Surat	} ...	33,000 {	16,135	18,919
Dhárwár	}		7,650	10,052
Mirpurkhás	...	...	15,980	13,569
Dhulia	...	...	...	2,940
Muvalia	6,000	9,500	...	...
Ganeshkhind Gardens	...	...	...	5,012
Bassein	12,000	10,000	...	...
Cotton Seed Distribution	10,000	10,000	...	...
Total ...	28,000	62,500	65,782	79,100
Agricultural Experiments.				
Lonávla Rice Experiments	...	...	...	1,870
Other Agricultural Experiments ...	...	...	5,000	10,250
Contribution to Ahmadnagar Show ...	...	...	450	...
Do. Ahmadabad do. ...	...	...	1,000	...
Purchase and Collection of Egyptian Cotton in Sind	...	...	3,000	...

APPENDIX C *continued.*

	Imperial Grant.		Provincial Grant.	
	Revised 1905-06.	Budget 1906-07.	Revised 1905-06.	Budget 1906-07.
Agricultural Experiments—contd.	Rs.	Rs.	Rs.	Rs.
Buildings Dhulia Farm	...	...	8,000	...
Additional Grant for purchase of land at Dhulia	...	...	6,000	...
Dhulia Farm	...	...	3,500	...
Supervisor, Cotton Experiments ...	...	...	...	2,996
Total ...	...		26,950	15,116
Minor reappropriations	16,000	...	...	...
Lump provision for temporary quarters of Agricultural Chemist and students ...	...	...	...	4,320
Grain compensation in lump	...	...	...	50
	16,000	...	...	4,370
	54,000	94,500	144,800	184,365
Public Works Grant	206,000	277,500	...	...
Less—Probable Saving	...	...	...	—4,865
Total ...	260,000	372,000	144,800	179,500
Deduct—Amount transferred from the Imperial Grant (*vide* Government Memorandum No. 3533 of 20th April 1906) ...	...	...	...	68,000
				111,500

ERRATA.

Annual Report of the Department of Agriculture for 1905-06.

Page 15, para. 20, *for* '18 inches' *read* '31 inches'.

Page 17, para. 39, *for* '37°' against mean maximum temperature in June, *read* '87°'.

Page 18, para. 53, *for* '2′ 4″' rainfall against December, *read* '2′ 48″' and *for* '8′ 0″' against January, *read* '0′ 0″'.

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ERRATUM.

Annual Report of the Department of Agriculture for 1905-06.

For the Temperature details for Dhulia shown in para. 53 at page 18 *substitute* the following :—

	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.
Mean maximum ..	100·5°	108·5°	105·5°	94·5°	88·0°	95·5°	94·0°	87·5°	89·0°	8[illegible]·5°	88·0°	97·0°
Mean minimum ..	63·5°	77·6°	73·5°	72·0°	71·0°	72·5°	61·5°	59·0°	46·0°	48·0°	51·0°	57·6°

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PORTA DA TERRA
CHURCH
BATH
FRANCISCAN CHURCH OF THE INVOCATION OF SANTO ANTONIO
S. SEBASTIAN GATE
THE DOMINICAN CHURCH AND CONVENT
BASEMENT OF I.E. CROSS
PALACE OF THE CAPTAIN OF BASSEIN
PALACE OF THE GOVERNOR GENERAL OF THE NORTH
CHURCH OF NOSSA SENHORA DA VIDA
CITADEL
RUINS
ST. PAUL'S CHURCH OR CHURCH AND MONASTERY OF THE JESUITS
THE CATHEDRAL OF ST. JOSEPH
PORTA DO MAR
EAST OR SEA GATE
Reduced to ½ Scale from Original.
Govt Photozincographic Office. Poona. 1908

Annual Report of the Department of Agriculture of the Bombay Presidency for the year 1905-06.

No. 10693.

REVENUE DEPARTMENT.

Bombay Castle, 10th November 1906.

Letter from the Director of Agriculture, No. A.—4750, dated 5th September 1906—Submitting a copy of the Annual Report of the Department of Agriculture of the Bombay Presidency for the year 1905-06; and making remarks.

RESOLUTION.—The unsatisfactory nature of the season, following the unfavourable year 1904-05, of necessity retarded experimental work considerably, and in large measure rendered results inconclusive. Nevertheless, as shown in the summary of reports on the working of agricultural stations, which is annexed to the report, important conclusions have been or are in course of being established, particularly in regard to crops grown with the assistance of irrigation on those farms which enjoy the use of a full supply of water. Government fully concur in the Director's opinion (paragraphs 20 and 21 of his report) that illustration of proper and economic methods of using irrigational advantages is at present one of the most important objects to be aimed at in experimental work, and that it is of great importance that agricultural stations should be established in lands which receive irrigation. But although experimental results are frequently spoilt by vicissitudes of season on dry lands, it is at least equally important that experiments should be conducted on such lands without attempting to give irrigation to save the crops. Among other reasons it is important to note the results of vicissitudes of season, and Government have recently issued separate orders requiring that on the principal Government farms an area shall be set apart for the growth of the ordinary dry crops with no special object in view beyond the securing of the largest and most profitable outturn from resources open to every reasonably skilful and intelligent cultivator. It is to be expected, of course, that, with the skilled management and efficient cultivation given on a Government farm, such crops will be at least equal, indeed they ought to be decidedly superior, to those of the ordinary cultivator, except in those parts of the country where he is specially skilled. They will, however, fluctuate, as his do, with the season. If a proper record is kept of yields and expenses of cultivation, some idea will be gained of the effects of seasonal fluctuations on the outturn and profitableness of cultivation, on which useful inferences may be founded. The results obtained on these areas will also give a useful test of the efficiency of the farm operations. It is noticeable that on all the farms unprovided with irrigational facilities the yield of the crops was exceedingly poor. It is not stated, however, how that yield compared with the yields in the neighbourhood. This point should invariably be noticed in future reports.

2. Another point on which valuable information might be collected if close observations were made on areas of ordinary crops cultivated without irrigation would be whether by any improvements of method more effective resistance could be opposed to drought. In this connection the report that in Surat and one or two other stations the unmanured plots did better than manured plots is surprising and needs verification. It is believed that on the Poona Farm Mr. Mollison considered the opposite result to have been established, and found that its crops, owing to superior manurial and cultural preparation of the land, got the better start, and showed notably superior results in years of severe drought, compared with those of surrounding cultivators, who had failed or were unable to give their land the same thorough treatment. As an example of the result which should be kept in view, the attention of the Department should be drawn to extraordinary improvements claimed to have been

effected in America, in the system of what is known as dry farming, which is in use on the arid plains lying between the Missouri River and the Rocky Mountains, where the rainfall averages no more than 12 inches, but where by means of nothing but diligent and skilful tillage crops are obtained on unirrigated land equal to the best outturns with the aid of irrigation.

3. It is significant that the only farm on which even a modest profit is shown is the farm at Mánjri which receives regular irrigation. One most valuable fact seems to have been demonstrated beyond question on this farm, namely, the effectiveness and cheapness as a manure of safflower cake, even at the high prices prevailing during the year of report. This result must have been seen by the cultivators who have visited the farm, and it would have been interesting to have had information as to the extent to which the cake is being utilised as manure.

4. The present aspect of the cultivation of Egyptian cotton in Sind is described in Appendix B of the Director's report, to which as well as to the published Press Note on the subject attention is recommended. Despite the disappointing outturn, due in part to the apathy shown by the Sindhi cultivator in adopting improved methods of cultivation, and in part to particular causes such as the character of the season and the prevalence of insect pests, Government are confirmed in the opinion that the condition of this experiment within so short a time of its inception is decidedly hopeful. Government have recently been in correspondence with the Commissioner in Sind and the Director of Agriculture over the prospects of the crop in the current year. These are apparently very fair in the area south of Mirpur Khás, but less satisfactory north of it. There is also every chance of keen competition for the purchase of the crop and of the zamindárs obtaining much better prices than last year. Special machinery has been provided to assist the zamindárs in bringing their crops to market. This, however, will act mainly as a reserve in case ordinary trade agencies are insufficient, and it is believed and hoped that the zamindárs and purchasers will not require to make use of the assistance provided by the authorities. The District Officers, under the guidance of the Commissioner in Sind, are throwing themselves with enthusiasm into the work of helping through the operations of the year. The cultivation extends to 6,000 acres, and next year, it is hoped, will show a still larger area.

5. It is disappointing, however, that the yield of Egyptian cotton on the Government farm at Mirpur Khás should have proved altogether inferior to those obtained by the zamindárs. The result is not *primâ facie* creditable to the farm. It is said that the soil contains a large proportion of "kalar" or alkali and is therefore unsuitable to the crop. Efforts are being made to discover how to get rid of or counteract the "kalar". But it is obvious that experiments on bad soil will not help much to develop the cultivation of the cotton, and if the farm does not contain suitable soil, plots of such soil must be obtained elsewhere and the cotton grown on them. Only by success in growing fine crops will the superiority of the Egyptian methods of cultivation be conclusively demonstrated to the zamindárs, who in the absence of such demonstration will cling to the less laborious indigenous methods. It should also be ascertained beyond question whether any large portion of the land of the farm is under the average in quality. If this is the case, a new site had better be obtained, before the expense is incurred in buildings, equipment, and establishment on a farm which may prove a failure.

6. The investigation of the "alkali" question is a matter of great importance, and the Commissioner in Sind has been requested to furnish further facts necessary for the determination of the lines on which the inquiry shall proceed.

7. It is observed that two new stations were opened during the year, that some extension of existing stations was made, and that considerable improvement was effected in their equipment, including the provision of farm buildings. The Botanical station at Bassein has already begun work.

8. Government concur with the Director's opinion expressed in paragraph 31 of his report as to the great importance of entomology in the scheme of

agricultural investigation. Although as yet no very satisfactory method has been devised of dealing with an extensive visitation of locusts, such as occurred in the year 1903-04, it is permissible to repeat the expression of opinion recorded in Government Resolution No. 4367, dated 3rd May 1906, that the very considerable knowledge which has been obtained of the life history of these pests will prove of use in the event of their reappearance. As to the danger which is apprehended of a possible invasion of this country by the cotton boll weevil which has caused so much damage in America, Government can only endorse the hope expressed by Mr. Lawrence that the precautions taken will prove effective.

9. In paragraph 28 of the report allusion is made to the destructiveness of white ants in sandy soil, and it is stated that when the rains are abundant the ravages of the pest are diminished. But experience on the Nadiád Farm during the current year 1906-07, in which the rains have been abundant, is likely, it is feared, to throw doubt on this conclusion. The subject is evidently one of considerable moment, and the investigations should be energetically pursued into the mode of meeting the attacks of the pest, which, it is to be feared, does considerable damage whatever the character of the season.

10. The Governor in Council is fully in accord with the opinion expressed in paragraph 37 of the Director's report, as to the value of the annual course of instruction to Junior Civilians in agriculture. The importance of active co-operation with the work of the Department on the part of District Officers was insisted on in the review of Mr. Lawrence's last report, to which attention is invited; and practical instruction in elementary facts of agriculture is not likely to render their help the less useful. On the contrary it is, as the Director points out, of great importance that the young District Officer should, for the proper performance of his duties and in order to win the confidence of the people, be able to look at the crops of the country with the eye which sees, and that his powers of observation should be directed to agricultural matters. While it is no doubt true, as the Director remarks, that the spread of knowledge among the people must be limited by the amount of expert assistance available, and progress for the present must accordingly be somewhat slow, it is obvious that District Officers can in the way indicated in paragraph 3 of Government Resolution No. 4367, dated 3rd May 1906, do much to supplement such assistance.

11. It is satisfactory to observe that useful work has been done in the publication of agricultural information by means of leaflets and bulletins, and it is noticed that the more intelligent cultivators increasingly and unmistakably show their interest in the work of the Department and the results established by it, by their attendance at the lectures given by Inspectors or Superintendents while on tour, by visiting the farms where ocular demonstration of results is available, and by trying the selected seed and improved instruments supplied to them. Much, however, remains to be done in the way of effective dissemination of agricultural information, and for this purpose the expert agency requires to be largely increased.

12. Government are disposed to concur with Mr. Lawrence's observations on the subject of Agricultural Associations. It will be wise to draw a lesson from Egyptian experience, and not to start numerous District Associations until, like the successful body in Dhárwár, they can be provided with expert secretaries.

13. Mr. Lawrence leaves the Department in an efficient condition, and on the eve of considerable expansion. The remarkable increase which has within the last year or two taken place in the number of agricultural students at the College of Science is one indication of the general spread of interest in scientific agricultural methods. Good progress has been made already with the institution of a large and well-equipped Agricultural College, the completion of which will, it is hoped, be an accomplished fact at no distant date. To the College we must look for the provision in the beginning of subordinate teachers, and assistants in the work of research, and eventually, it is hoped, of men of

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original talent and capacity who will be able to do some of the work for which reliance has at present to be placed on European experts. From this institution also must issue the band of men required to work as Farm superintendents, demonstrators, itinerant instructors and secretaries of associations, as well as those who are intended to provide the Revenue Service with a leaven of officers fully instructed in the science and practice of agriculture. In addition to these important educational functions the College will be the Provincial Institute of Agricultural Research. There can be no doubt that this institution has a most valuable future in store, and the best efforts of Government will be given to render it thoroughly efficient. It has at present the nucleus of an excellent staff, whose exertions during the year of report merit fully the cordial appreciation recorded by the Director.

14. Government note with satisfaction that the Deputy Director Mr. Fletcher is publishing what is expected to prove an important contribution on cotton. The value of Mr. Gammie's work on the same subject has lately received the appreciative acknowledgments of the Government of India. Mr. Knight, besides conducting his professional duties with ability, is responsible for the relatively satisfactory results obtained on the Mánjri Farm, and Mr. Meggitt has shown resource and energy in taking up his work as Professor of Agricultural Chemistry.

15. It remains only for the Governor in Council to repeat the expression of appreciation of Mr. Lawrence's administration, recorded in paragraph 4 of Government Resolution No. 4367, dated 3rd May 1906, to which, as was there observed, the promising condition of the Department and the successful results already attained by it are in large measure due.

E. G. TURNER,
Acting Under Secretary to Government.

To

The Commissioner in Sind, The Commissioner, N. D., The Commissioner, C. D., The Commissioner, S. D., All Collectors, including the Collectors and Deputy Commissioners in Sind.	With one copy of the report, and with an intimation that the requisite number of copies of it will be supplied to them by the Director of Agriculture.
The Director of Agriculture, The Director of Land Records, The Conservator of Forests, N. C., The Conservator of Forests, C. C., The Conservator of Forests, Sind Circle, The Deputy Conservator of Forests in charge S. C., The Colonization Officer, Jámráo Canal, The Accountant General, The Private Secretary to His Excellency the Governor, The Director of Public Instruction, The Principal, College of Science, Poona, The Educational Department of the Secretariat, The Political Department of the Secretariat, The Public Works Department of the Secretariat.	With copies of the Report.
The Government of India, The Under Secretary of State for India.	By letter.

No. of 1906.

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